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9/27/2001

Record of Decision

Northwest Pipe and Casing Company / Hall Process Company
Groundwater Operable Unit (OU 2)

Clackamas County, Oregon

September 2001

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DECLARATION OF THE RECORD OF DECISION

SITE NAME AND LOCATION

Northwest Pipe and Casing Company / Hall Process Company
Groundwater Operable Unit (OU 2)
S.E. Mather Road and S.E. Industrial Way
Clackamas County, Oregon

CERCLIS Identification Number: ORD 980988307

STATEMENT OF BASIS AND PURPOSE

This Decision Document presents the selected remedial action for the Groundwater Operable Unit (OU) for the Northwest Pipe and Casing Company / Hall Process Company Site ("NWPC"), located at 9571 SE Mather Road in Clackamas, Oregon. This Record of Decision (ROD) has been developed in accordance with the requirements of Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) of 1980, 42 USC §9601 *et seq.* (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision is based on the Administrative Record for the Site.

The groundwater remedy was selected by the U.S. Environmental Protection Agency. The State of Oregon concurs with the selected groundwater remedy.

ASSESSMENT OF THE SITE

The Northwest Pipe and Casing Company / Hall Process Company site is located in Clackamas, Oregon and covers approximately 53 acres of land.

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy for the Groundwater OU addresses contaminated groundwater at the site. This is the second ROD issued and is expected to be the final ROD for the site. In June 2000, EPA issued a ROD for contaminated soil (OU 1).

The cleanup strategy for groundwater at the site will address groundwater contamination through source control, treatment, natural processes and institutional controls. The most-highly contaminated groundwater will be treated by *in-situ* air stripping wells. Lesser-contaminated groundwater will be addressed through natural processes.

The major components of the selected remedy for the groundwater OU include:

- Installing *in-situ* air stripping wells in four plumes of contaminated groundwater to treat groundwater contaminated with high levels of volatile organic chemicals (VOCs);

- Installing *in-situ* air stripping wells in the vicinity of Lawnfield Road to prevent off-site migration of contaminated groundwater;

- Using natural processes, including volatilization, dispersion, dilution, absorption and chemical reactions with subsurface materials to reduce the VOC concentrations in groundwater outside of the source areas;

- Installing and periodically sampling groundwater monitoring wells to evaluate the effectiveness of *in-situ* air stripping and measure progress towards achieving groundwater remediation (cleanup) goals;

- Controlling erosion during construction of the groundwater remedy to minimize impacts from excessive sediment to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish; and

- Limiting future access to and use of site groundwater, through institutional controls including a restrictive covenant which will run with the land, to ensure the remedy remains protective of human health.

STATUTORY DETERMINATIONS

The selected remedy for the groundwater OU is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate for the remedial action, is cost-effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable.

The selected remedy satisfies the statutory preference for remedies employing treatment as a principal element to reduce the toxicity, mobility, or volume of hazardous substances.

Because this remedy will result in hazardous substances remaining above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the remedial action (and at 5-year intervals thereafter) to ensure that the remedy continues to provide adequate protection of human health and the environment.

DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern (COCs) and their respective concentrations. (See Section 5.6)

- Baseline risk represented by the COCs. (See Sections 6.3.4 and 6.4.3)

- Cleanup levels established for COCs and the basis for these levels. (See Section 7.2)

- How the source materials constituting principal threats are addressed. (See Section 11.6)

- Current and reasonably anticipated future land and groundwater use assumptions used in the baseline risk assessment and ROD. (See Section 6.2)

- Potential land and groundwater uses that will be available at the site as a result of the selected remedy. (See Section 10.3)

- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected. (See Section 10.4)

- Key factors that led to selecting the remedy. (See Section 10.1)

Michael F. Gearheard, Director
Office of Environmental Cleanup
United States Environmental Protection Agency, Region 10

27 Sept. 2001
Date

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CONTENTS

APPENDIX

FIGURES

TABLES

ABBREVIATIONS AND ACRONYMS

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC	chemical of concern
CT	central tendency
DCE	dichloroethene
DEQ	Oregon Department of Environmental Quality
DNAPL	dense non-aqueous phase liquids
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
FS	feasibility study
FWQC	Federal Water Quality Criteria
HI	hazard index
HPAH	high molecular weight polynuclear aromatic hydrocarbon
IRIS	Integrated Risk Information System
L	liter
MCL	maximum contaminant level
μg	microgram
mg/kg	milligrams per kilogram
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PAH	Polynuclear aromatic hydrocarbon
PCB	Polychlorinated biphenyls
PCE	tetrachloroethene
PRG	preliminary remedial goal
PRP	potentially responsible parties
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RG	remediation goal
RI	remedial investigation
RME	reasonable maximum exposure
ROD	record of decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SF	slope factor
TCE	trichloroethene
TSCA	Toxic Substances Control Act
UCL	upper confidence limit
VOC	volatile organic compound

DECISION SUMMARY

INTRODUCTION

This Decision Summary provides a description of the site-specific factors and analyses that led to selection of the groundwater remedy for the Northwest Pipe and Casing / Hall Process Company Superfund Site (Site). It includes information about the Site background, the nature and extent of groundwater contamination, the assessment of human health and environmental risks, and the identification and evaluation of remedial alternatives.

The Decision Summary also describes the involvement of the public throughout the process, along with the environmental programs and regulations that may relate to or affect the alternatives. The Decision Summary concludes with a description of the selected remedy in this Record of Decision (ROD), and a discussion of how the selected remedy meets the requirements of the Comprehensive Environmental, Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and the the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300.

Documents supporting this Decision Summary are included in the Administrative Record for the Site. Key documents include the Final Remedial Investigation Report, the Final Feasibility Study Report, the Human Health and Ecological Baseline Risk Assessment Report, the 1999 Long-Term Groundwater Monitoring Report, the Draft Technical Memorandum-Addenda to the 1999 Final Feasibility Study, the 2000 Supplemental Groundwater Investigation and Monitoring Report and the Groundwater OU Proposed Plan for the Site.

This Site consists of two operable units, OU 1 for soil and OU 2 for groundwater. The designation of operable units for response actions is discussed in Section 4. This ROD is for OU2; a ROD for OU 1 was issued by EPA in June 2000.

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1.0 SITE NAME, LOCATION, DESCRIPTION AND HISTORY

1.1 SITE NAME, LOCATION AND DESCRIPTION

The Northwest Pipe and Casing Company / Hall Process Company site lies within the lower Willamette River basin of western Oregon, in a north-south trending valley between Mount Talbert to the east and a low bluff to the west. The site is located between SE Lawnfield and SE Mather Roads in Clackamas County, Oregon (**Figure 1-1**), and is approximately twenty miles southeast of Portland. The CERCLIS ID number for this site is ORD 980988307. The site is adjacent to Southern Pacific Railroad tracks and approximately one-half mile east of Interstate Highway 205.

The U.S. Environmental Protection Agency is the lead agency and the Oregon Department of Environmental Quality is the support agency. The remedial and removal actions described in this ROD have been and will be conducted by EPA utilizing the Superfund trust fund and an EPA special account containing settlements funds from responsible parties. The state of Oregon has provided support concerning state of Oregon cleanup requirements.

The site is located in a mixed commercial and light industrial district. The Camp Withycombe Air National Guard facility is located to the immediate southeast of the site. Adjacent businesses to the east along Mather Road include several metal salvage and related operations and a truck manufacturing facility. Property immediately east of the site, formerly an automobile junkyard, is currently vacant. A small residential community known as Hollywood Gardens is located immediately south of Camp Withycombe. The bluff west of the site is occupied by a collection of retail and commercial businesses concentrated along SE 82nd Avenue, including restaurants, motels, gas stations, stores and an elementary school.

The site covers approximately 53 acres of land. For purposes of EPA's prior site investigations, the site was divided into two parts, Parcel A (21 acres) and Parcel B (32 acres), based on historical uses of the properties (**Figure 1-2**).

The valley in which the site is located is drained by Dean and Mount Scott Creeks, which flow to the north-northwest and eventually flow into the Willamette River. The site is relatively flat. Standing water on Parcel B is common during the rainy season, as a result of poor drainage. A small area of wetlands is present on the northwest area of Parcel B. Surface drainage from Parcel A is largely contained in storm drains. Surface water runoff from Parcels A and B drains into manmade ditches along the east and west boundaries of the site, subsequently draining into Dean Creek (**Figure 1-3**).

1.2 SITE HISTORY

Beginning in 1967 and lasting until operations ceased in 1985, Northwest Pipe and Casing Company (NWPC) manufactured and stored steel pipe on Parcel A. Beginning in 1956, Hall Process Company (HPC) operated a pipe-coating facility on Parcel B. In 1978, HPC ceased operations and the pipe-coating facility on Parcel B was leased to NWPC, which continued pipe-coating until 1985.

Pipe coating operations involved sandblasting pipe with steel shot, spraying the pipes with primer, and applying the coating material. Coal tar, coal tar epoxy, asphalt, polyethylene epoxy, and concrete were used as coating materials. A volatile-organic based primer was used to adhere pipe coatings and solvents were used in the maintenance of pipe-coating equipment.

The majority of coal tar coating took place in and around former Plants 3 and 4 on Parcel B; less pipe coating occurred at Plant 2, while polyethylene epoxy coating occurred in Plant 1. Coal tar was brought to the site in solidified form and then heated to liquify it prior to use. Several underground tanks on Parcel B were used to store fuel and possibly waste oil. On Parcel A some used solvents, oil and water mixtures and metal filings were disposed of directly on the ground. Wastes from the pipe-coating operations were also disposed at various locations on Parcel B by burial, dumping, burning and spreading. These wastes included used solvents from maintenance activities, primers, excess coating material (coal tar), coating product containers, condensed coal tar residues and oils, pipe trimmings, and engine and hydraulic oils. Leaks and spills from equipment and containers also occurred on Parcel B.

Historical, on-site disposal and mishandling of wastes from pipe manufacturing and pipe coating operations are the primary sources of contamination at the site. Soil at the site is contaminated with PAHs and PCBs. Coal tar used for coating pipes was the main source of PAH contamination of the soils. PCBs in the soil most likely originated from cutting oils, hydraulic oils, cooling oils, and/or electrical transformers used at the site. PCB-contaminated oils may have been used for on-site dust suppression based on their widespread detection in shallow soils. Groundwater at the site is contaminated with volatile organic chemicals (VOCs). Cleaning solvents used by the facilities was the main source of VOC contamination of the groundwater.

DEQ conducted a preliminary assessment of the site in 1987. Following unsuccessful attempts by DEQ to have potentially responsible parties undertake remedial investigations, in 1989 and 1990 EPA conducted a Preliminary Site Inspection and a Listing site Inspection respectively.
EPA placed the Northwest Pipe and Casing Company site on Superfund National Priorities List on October 14, 1992. EPA initiated a Remedial Investigation and Feasibility Study in 1996 and conducted a baseline risk assessment in 1998. Additional groundwater monitoring was conducted in 1999. A supplementary groundwater investigation was conducted in 2000.

A CERCLA removal action, consisting of perimeter fencing, warning signs, demolition of vacant buildings and off-site disposal of demolition debris was conducted on Parcel B in 1993. The removal action was taken to restrict exposure of trespassers or transients to site contaminants. Approximately 230 tons of surface debris -- coal tar, abandoned car tires and batteries, were removed from Parcel B in 1997 prior to the Remedial Investigation. Two underground storage tanks (USTs) were removed from Parcel B in 1998. Site security patrols on Parcel B were started in 1999 to combat recurring transient trespass on the site.

A ROD for the Soil Operable Unit (OU 1) was issued by EPA in June 2000. Construction of Phase 1 of the soil remedy, which includes excavation and off-site treatment/ disposal of the most highly contaminated soil, started August 1, 2001 and is expected to be completed in November 2001. Phase 2 of the soil remedy will include placement of a clean soil cap over Parcel B at a future date.

The Oregon Department of Transportation (ODOT) has owned the western part of Parcel A since 1985 and used it for equipment yard and warehouse/office. The eastern lot of Parcel A has been owned by Northwest Development Corporation since 1985 and is occupied by three low-rise buildings housing commercial businesses.

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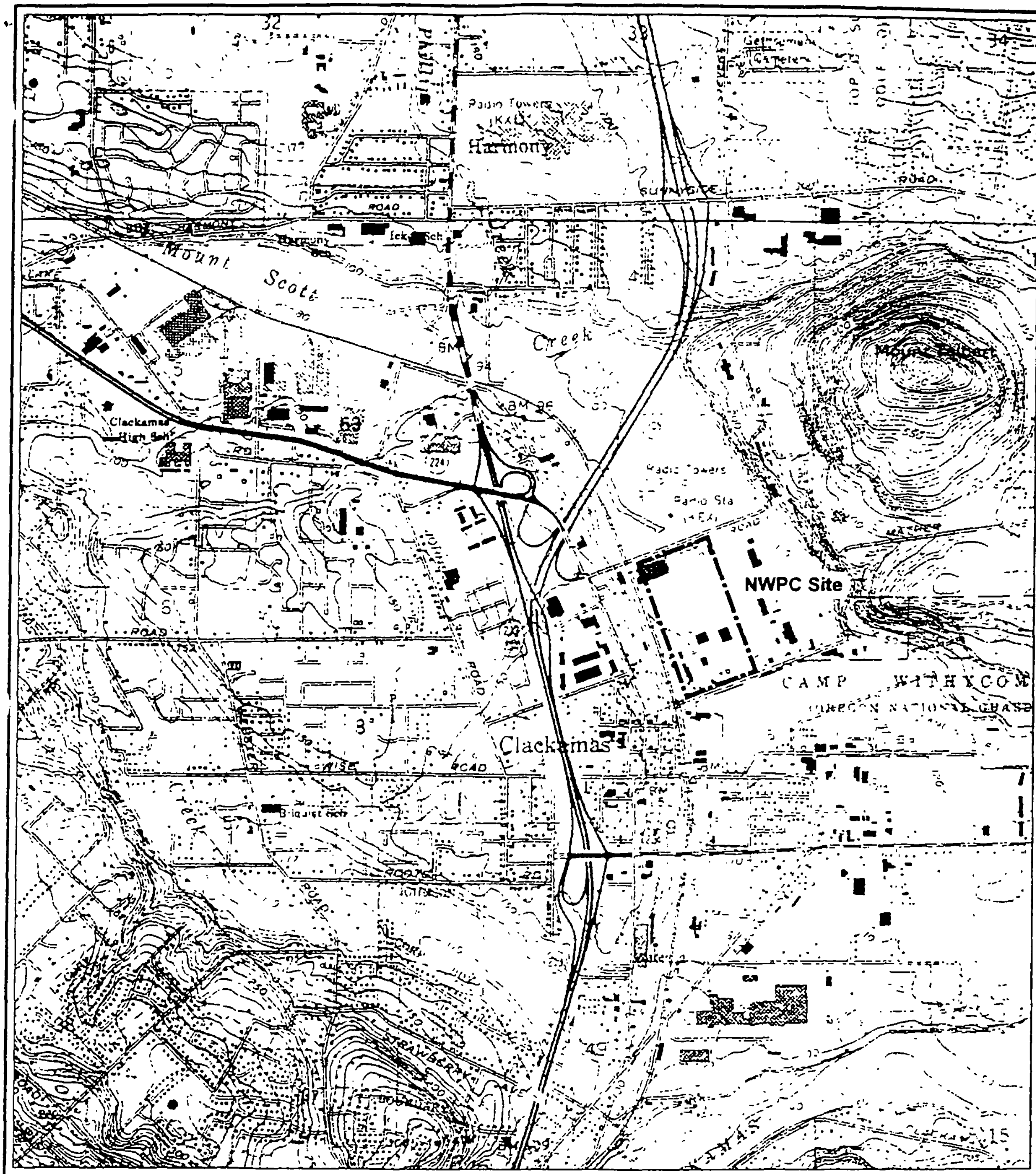


0 1000 2000
Scale in Feet

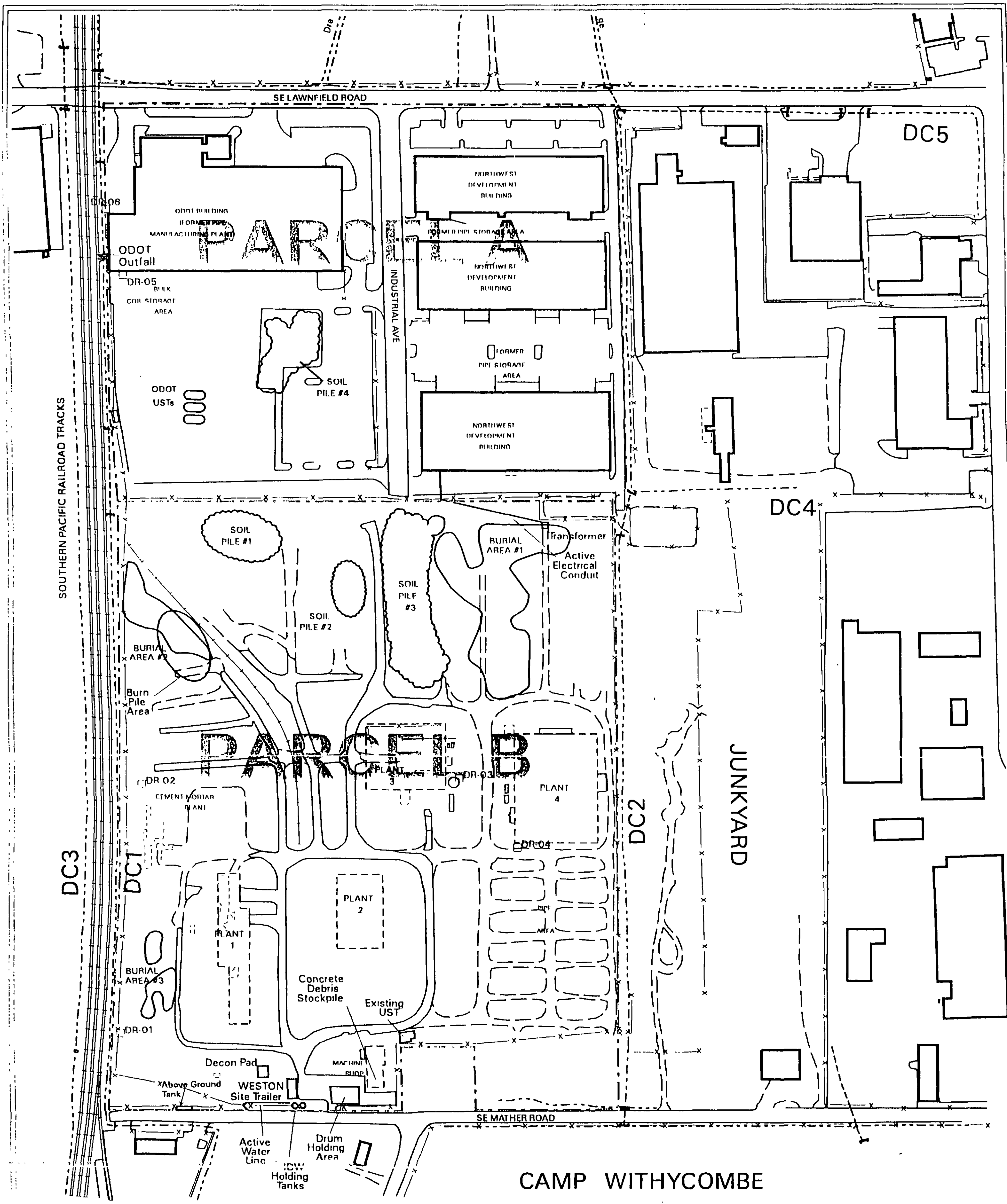
Source: USGS 7.5' Quadrangle Series - Gladstone, OR (1961, PR 1984)

Northwest Pipe & Casing RI Site Vicinity Map

WESTON
MANAGERS DESIGNERS/CONSULTANTS

97-988 Fig1-1.fh7

Figure 1-1



BASEMAP EXPLANATION	SYMBOL EXPLANATION
Paved road	Drainage channel with flow direction
Soil pile/Burial area/UST	Drainage below ground surface
Building	DC 3 Drainage channel identifier
Site boundary	DR-01 Vertical drain
Railroad	
Fence	
Unpaved road	
Former plant location	
Concrete pad/foundation	

SCALE 1:2700

50 0 50 100 150 200

Feet

NWP&C Site

NOTES

NWP&C Site Features

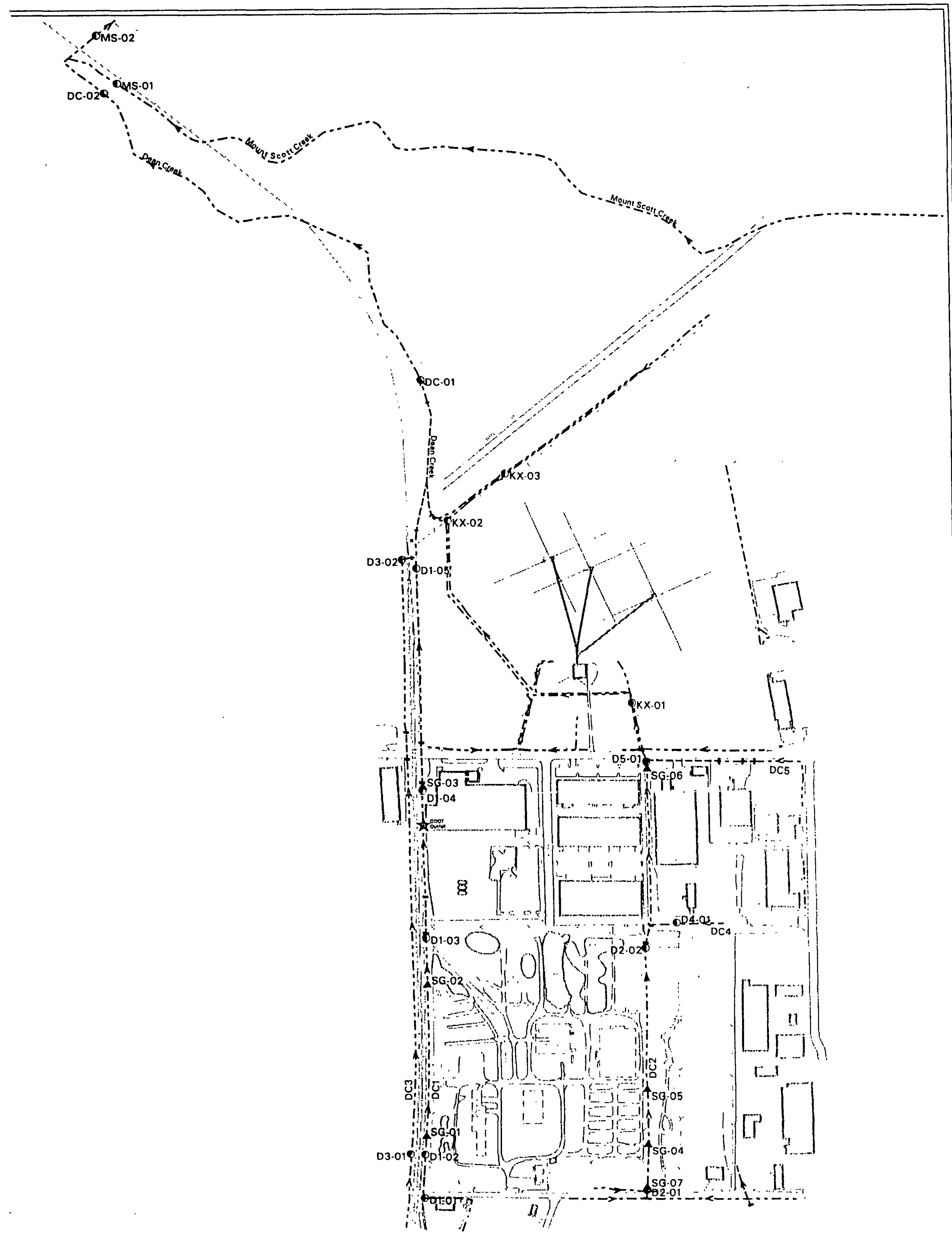
WESTON

DATE April 21, 1998 10 42 AM
JOB NUMBER 04000-036-001-7100-00
VIEW FILE: sitemap view

CHECKED BY: KAP

APPROVED BY: KAP

Figure 1-2



XPLANATION

oad

/Burial area/UST

d

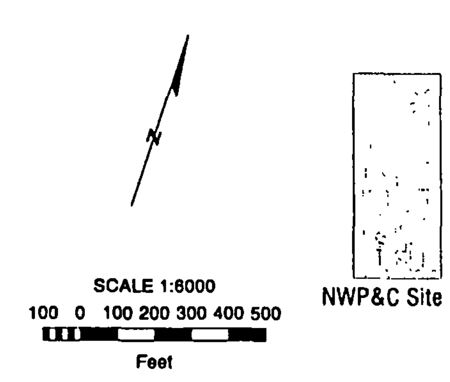
d road

plant location

te pad/foundation

SYMBOL EXPLANATION

- Sediment/Surface water sample
- Discharge location of ODOT shallow groundwater dewatering system
- Stream gauge
- Drainage channel with flow direction
- Drainage below ground surface



NOTES

DATE: April 06, 1998 1:10 PM
JOB NUMBER: 04000-036-001-7100-00
VIEW FILE: sedexplorstns.view
CHECKED BY: KAP
APPROVED BY: KAP

NWP&C RI: Surface Water and Sediment Exploration Locations

Figure 1-3

2.0 SITE ENFORCEMENT ACTIVITIES

The EPA conducted previous investigations at the site in 1988 through 1990. The results of these investigations are contained in the *Site Inspection Report, December 1988* and the *Listing Site Inspection Report*, June 1990. Based on these investigations, EPA proposed the site for inclusion on the National Priorities List (NPL) on February 7, 1992. The site was added to the NPL on October 14, 1992.

EPA issued special notices to potentially responsible parties in June 1995 for conduct of the RI/FS. These parties included: Northwest Pipe and Casing Company; Oregon Department of Transportation; Wayne Hall, Jr.; and Northwest Development Corporation. The responsible parties declined to conduct the RI/FS. In 1997 and 1998, consent decrees between EPA and the State and these parties were entered in federal courts. Under the consent decrees, the settling parties are not obliged to carry out remedial actions for the site. Therefore, EPA is conducting the necessary remedial actions. The consent decrees included monetary payments by the settling parties to EPA and the State to be used for response activities. The consent decree with Mr. Hall also transferred ownership of Parcel B to DEQ, as trustee for EPA and DEQ.

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3.0 COMMUNITY RELATIONS

The Proposed Plan for the Groundwater OU, as well as the Remedial Investigation Report, Feasibility Study Report, Human Health and Ecological Baseline Risk Assessment Report, 1999 and 2000 Groundwater Monitoring Reports, and Draft Technical Memorandum-Addenda to the 1999 Final Feasibility Study, and other technical and site-related documents were made available to the public in May 2001. They can be found in the Administrative Record file, which is located at the Clackamas County Library, Clackamas Corner Branch, located at 11750 SE 82nd Avenue, Suite D, Clackamas, Oregon, at the EPA, Oregon Operations Office, located at 811 SW Sixth Avenue, 3rd Floor, Portland, Oregon, and the Superfund Records Center, EPA Region 10, 1200 Sixth Avenue, Seattle, Washington.

A public comment period for the proposed plan for the groundwater OU was held from May 17 through June 18, 2001. The notice of availability of the proposed plan and opportunity to comment was published in the Oregonian newspaper on May 17, 2001. The proposed plan was mailed to all approximately 150 persons on EPA's mailing list for the site. A public meeting was not held due to the lack of a request. No public comments were submitted, however comments were submitted by ODOT and Clackamas County Water Environment Services. EPA's response to the comments received during the public comment period is included in the Responsiveness Summary, which is a part of this Record of Decision.

A community relations plan for the site was prepared in 1992 and a mailing list of persons interested in the site has been maintained. Fact Sheets have been issued by EPA in 1992, 1993, 1997, 1999, 2000 and 2001 providing the public with information about the Superfund process and EPA activities at the site.

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4.0 SCOPE AND ROLE OF RESPONSE ACTION

This section describes the scope of the selected response action and its role within the overall site management strategy. Past response activities, response actions selected in this ROD, and future response plans are outlined.

4.1 Designation of Operable Units

The Northwest Pipe and Casing Company site involves multiple contamination problems. The site Remedial Investigation identified contamination of soil, groundwater, surface water and sediments. For the purpose of managing the site-wide response actions, EPA has organized response actions for site contamination problems into two operable units (OUs):

- Operable Unit 1: Contamination of soils and debris
- Operable Unit 2: Contamination of groundwater

The Soil OU ROD was issued in June 2000; however, further groundwater investigation was needed prior to issuing a ROD for OU2. By organizing the site contamination problems into two operable units, necessary response actions for soil and groundwater are able to proceed independently as soon as they are ready.

EPA determined in the Soil OU ROD that no response actions were needed for surface water and sediments. Contamination of these media did not present unacceptable risks to human health or the environment.

Designation of groundwater and soil operable units at the Northwest Pipe and Casing Company site is consistent with the National Contingency Plan which defines an OU as a discrete action that comprises an incremental step toward comprehensively addressing site problems.

4.2 Past Response Actions

Several removal actions have been conducted by EPA to restrict transient access to the site and minimize direct contact with debris and soil contamination. These removal actions are detailed in the Soil OU ROD. The final soil response actions selected in the 2000 Soil OU ROD are being conducted in two phases. Construction of Phase 1, which includes removal of the most highly contaminated soil, started in August 2001, and is expected to be completed in November 2001. Phase 2 is the placement of a two-foot soil cap over Parcel B and is planned for construction in 2002 or later, pending the availability of funding.

4.3 Response Actions Selected in this ROD for Operable Unit 2

The action selected in this ROD addresses Operable Unit 2, contaminated groundwater at the site. Direct contact with groundwater poses a potential future risk to construction workers and maintenance workers at the site and to future off-site residents using groundwater for domestic purposes, because EPA's acceptable risk ranges for such exposures would be exceeded if no action is taken. Groundwater at the site is contaminated with hazardous substances, including VOCs. There is no current use of groundwater at the site.

The selected response action will treat the most highly contaminated groundwater using air stripping wells installed in the four groundwater plumes and will use natural processes to reduce the VOC concentrations in groundwater outside of the source areas of the plumes. The selected response action also will restrict the potential for off-site migration through the installation of air stripping wells in the vicinity of Lawnfield Road. Long-term groundwater monitoring will be conducted to evaluate groundwater remedy performance, adjust treatment system operations and track progress towards achieving the groundwater remediation goals. Institutional controls will be implemented to control potential exposure to on-site groundwater with VOC concentrations above the remediation goals.

This remedy is consistent with the Presumptive Response Strategy for Contaminated Ground Water.

4.4 Future Response Actions

At this time, EPA does not expect to conduct any further response actions at the site beyond the actions selected in the Soil OU and Groundwater OU RODs.

5.0 SUMMARY OF SITE CHARACTERISTICS

This section summarizes regional characteristics and site conditions, including discussions of the ecological setting, climate, surface water patterns, geology, and hydrogeology. The nature and extent of chemicals of concern in groundwater at the Northwest Pipe and Casing Superfund site are also discussed. The extent of soil, surface water and sediment contamination is only briefly described herein, since the Soil OU ROD covered these areas in detail.

5.1 ECOLOGICAL SETTING

5.1.1 FLORA AND FAUNA

The study area is situated within the Willamette Basin. The development that has taken place in the vicinity of the site has altered the natural vegetation of the site, making it less likely that many wildlife species would use the area. Parcel A lacks any significant ecological habitat due to its nearly complete cover with buildings and pavement. Existing habitat types within Parcel B include upland non-forested/disturbed, scrub/shrub, upland mixed deciduous, and aquatic flowing and non-flowing habitats. Due to extensive past disturbances at the site, the vegetative composition is relatively uniform and lacking diversity. Approximately 40 percent of Parcel B consists of pavement, angular to subangular gravel, or barren soil.

The majority of vegetated areas are dominated by three to four non-native species, including Himalayan blackberry, black cottonwood, Russian knapweed, reed canary grass and sphagnum moss. These species proliferate aggressively and are well known for establishing in areas of significant soil disturbance. The developed parts of the site, on Parcel A along SE Lawnfield Road, include numerous ornamental plants.

Terrestrial wildlife found within the site include a variety of mammals, including deer mice, raccoon, eastern cottontail and European rabbit. All of these species, except for the deer mice, have home ranges which are likely to extend beyond the site boundaries. The racer snake was the only reptile/amphibian observed at the site. Diverse populations of migratory and nonmigratory birds were observed within the site boundaries. Birds observed in highest abundance included American crow, American robin, European starling, killdeer, scrub jay, red-winged blackbird, California quail and song sparrow.

Two man-made drainage ditches are situated along the eastern and western boundaries of the site (**Figure 5-1**). Trash and various debris are present in many portions of these drainage ditches, and their substrates are characterized by dense vegetated bed with mixed sand, mud and gravel substrates. These ditches and associated bottom substrates do not provide significant habitat to aquatic organisms. Only one fish species, the mosquitofish, was observed in the ditches.

Dean Creek and Mt. Scott Creek downstream from the site provide wildlife habitat for resident and anadromous fish species. Mt. Scott Creek flows northward into Kellogg Creek which flows into the Willamette River. Mt. Scott and Kellogg Creeks provide spawning, nursery and adult habitat for anadromous steelhead trout and coho salmon, and resident cutthroat trout. Other significant anadromous species which use the Willamette River system include white sturgeon, pacific lamprey, chinook salmon, and American shad.

Several anadromous fish species of concern are known to be present in the Willamette River and Mt. Scott Creek and may possibly occur in Dean Creek. The National Marine Fisheries Service (NMFS) has listed the Lower Columbia River steelhead (*Onchorynchus mykiss*) as threatened, the Lower Columbia River/Southwest Washington coho salmon (*Onchorynchus kisutch*) as a candidate for listing, and the Lower Columbia River/Southwest Washington cutthroat trout (*Onchorynchus clark clarki*) as proposed for listing as threatened. The U.S. Fish and Wildlife Service has listed the Columbia River bull trout as threatened.

EPA conducted an informal consultation with the National Marine Fisheries Service (NMFS) in 1999 concerning the proposed soil and groundwater remedies. NMFS concurred with EPA's determination of no adverse effects on threatened or endangered fish.

The Nelson's checker-mallow (*Sidalcea nelsoniana*) plant is the only species potentially present at the site, based on habitat type, that is listed as either threatened or endangered. However, a plant survey conducted at the site determined that the plant was not present.

5.1.2 CLIMATE

The Northwest Pipe and Casing Company site is located in the Willamette River valley, approximately midpoint between the Pacific Ocean and the Cascade Mountain range. The climate in the region is characterized by dry summers and wet winter seasons. Prevailing winds in the spring and summer are from the southeast and in the winter and fall are from the north-northwest. Throughout the year, average speed is 7 to 10 miles per hour. Monthly precipitation averages range from almost 6 inches in January, November and December to less than 1 inch in July and August. The average annual precipitation is approximately 37 inches per year.

Historical winter daytime temperatures are typically between 40 and 50 degrees Fahrenheit (°F), while nighttime temperatures range in the mid-to upper 30's. Summer daytime high temperatures typically range in the mid- to upper 70's, with nighttime summer lows in the 50's.

Precipitation was unusually high when the Remedial Investigation was conducted in 1997. The annual precipitation for 1997 was 44 inches, or 7 inches above the annual average.

5.1.3 FLOOD PLAINS AND WETLANDS

The site is not in a floodplain, but is susceptible to ponding due to poor drainage. Groundwater is at or near the ground surface in the wet season. A small area of wetlands, approximately one acre in size, are present on the northwest part of Parcel B of the site and are shown on **Figure 5-2.**

5.2 GEOLOGIC CONDITIONS

The site is located within the Portland basin, a major sediment-filled depression found in the northern part of the Willamette River valley and adjoining the Columbia River valley. Geology of the area consists of coarse-grained Clackamas River fluvial deposits overlain by silt- and clay-rich flood deposits, such as those generated during the Missoula Flood of the Columbia River basin. The fluvial deposits in the vicinity of the site may have been deposited by the ancestral Clackamas River. These deposits are underlain by the Boring lavas, which are the younger basalts of the Columbia River Basalt Group. The uppermost regional unit is recent alluvium consisting of interbedded and variable silts, sands and gravels.

Five distinct subsurface geologic units have been identified at the site. The geologic conditions at the site are summarized on a geologic cross section of the area, presented as **Figure 5-3 and Figure 5-4** (**Figure 5-1** shows the cross section location).

Fill Unit - Imported silty gravels extending from ground surface to a depth of 1 to 1.5 feet.

Upper Silt Unit - Comprised of 90 percent silt and clay and 10 percent sand, topically moist. Extends to a depth of 4 to 6 feet bgs.

Upper Gravel Unit - Varies with depth from silty gravel in upper portion to well-graded gravels to cemented gravels in lower portion. Extends to a total depth of about 90 feet bgs.

Lower Silt Unit - Hard dark gray silt encountered at depths of about 90 feet bgs. Comprised of silt, clay and sandy silt.

Lower Gravel Unit - not encountered during EPA's Remedial Investigation, however the 2000 supplemental groundwater investigation included the installation of a monitoring well in the lower aquifer. Available information is supplemented with the drilling log for an existing well on Parcel A ("ODOT industrial well").

5.3 HYDROGEOLOGIC CONDITIONS

The hydrogeologic conditions beneath the site are depicted on cross-sections included as **Figures 5-5 and 5-6.** Two aquifer systems are located beneath the site. The Upper Aquifer consists of poorly sorted fine-to-coarse gravels and sandy gravels in the upper gravel unit which underlie the upper silt/fill/debris units. Occasional sand/silt zones or lenses, generally 1 to 2 feet thick, are noted. The Upper Aquifer extends to depths of 87 to 103 feet bgs. The upper aquifer is artificially divided into shallow, intermediate and deep zones, based on the depth of monitoring wells.

The Lower Aquifer is a gravel unit, located beneath the lower silt unit. The lower aquifer is artesian and consists of gravel and sandy gravel, as described by the well log for the ODOT industrial well which is screened in the lower aquifer beneath the lower silt unit. This well was reportedly used by Northwest Pipe and Casing Company for process water in pipe manufacturing. The ODOT well is not currently in use. The 2000 supplemental groundwater investigation included the installation of a monitoring well in the lower aquifer. Results of this investigation are discussed in Section 5.6.

Groundwater flow direction in the upper aquifer is generally towards the north and northwest, with no significant seasonal changes in direction observed (see **Figure 5-7**). Groundwater flow velocity in the upper aquifer at the site is estimated at 0.3 foot/day. The volume of groundwater flowing through the upper aquifer at the site is estimated to be 101,000 gallons/day.

Portions of groundwater from the shallow upper aquifer discharge to adjacent drainage channels DC1 and DC2. In the drier summer months, water is absent from DC1 and DC2, corresponding to periods when the upper aquifer water table drops below the bottom of the channels. It is unknown if the drainage channels have much direct influence on groundwater flow in the intermediate or deep parts of the upper aquifer.

Groundwater at and in the vicinity of the NWPC site is not currently used for drinking water, but has the potential to be used in the future. The closest known downgradient withdrawal of groundwater for domestic purposes is approximately one and one-half miles northwest of the site.

5.4 SITE FEATURES

Former and current site features are shown in **Figure 1-2**.

Parcel A

The western lot of Parcel A is currently owned by ODOT and is used as an equipment yard and warehouse/office. The majority of the lot is paved with asphalt and contains landscaped areas near the ODOT building. A soil pile (origin unknown) with an estimated volume of 2,100 cubic yards, is present south of the ODOT building. This pile will be managed under the Soil OU ROD. A 115-foot-deep industrial well is located on the north side of the ODOT building. Three 10,000-gallon fiberglass underground storage tanks (USTs) are located south of the ODOT building. One of the tanks was abandoned in place in 1993. The tanks contained gasoline and diesel. A 1,000-gallon steel UST located at the northeast corner of the ODOT building and used to store fuel was removed by ODOT in 1992. Two vertical drains are present along the ODOT building, apparently used to lower the local groundwater table to protect the building foundation from upwelling. The drains are connected to discharge pipes leading to the drainage ditch at the western edge of the ODOT building.

The eastern lot of Parcel A is owned by Northwest Development Company and is occupied by three low-rise buildings housing commercial businesses. This lot is paved with asphalt and contains small landscaped areas.

Parcel B

Parcel B is vacant and contains remnants of former pipe-coating operations. The lot is generally flat and overgrown with low-lying vegetation and thick blackberry brambles. Three soil and debris piles are present on the northern portion of Parcel B. These piles will be removed under the Soil OU ROD. A steel storage tank and two metal bins are located outside the site perimeter fence near the southwest corner of Parcel B. The tank has a capacity of approximately 12,000 gallons and is half full with hardened coal tar. The metal bins are approximately 1-3 cubic yards in size and partially full with household type refuse. These tanks and bins will be disposed of under the Soil OU ROD.

Several in-ground structures, including drains/sumps, and miscellaneous abandoned piping on Parcel B will be removed or managed in-place under the Soil OU ROD.

5.5 SAMPLING OF GROUNDWATER

Several phases of groundwater monitoring were conducted between 1996 and 2000. Activities included sampling at 62 push-probe locations and at 31 groundwater monitoring wells. The groundwater monitoring wells generally were located in areas where groundwater contamination was suspected. The monitoring wells were installed at different depths in the upper aquifer and one monitoring well was installed in the lower aquifer (see **Figure 5-8**). Monthly water level measurements were made and slug testing of selected monitoring wells was conducted.

5.6 NATURE AND EXTENT OF CHEMICALS

The nature and extent of groundwater contamination is summarized in the following subsections. Additional information is included in the Remedial Investigation Report and the supplemental 1999 and 2000 Groundwater Monitoring Reports.

5.6.1 Identified Chemicals

Chlorinated solvents, principally perchloroethylene (PCE), also known as tetrachloroethene, are the primary chemicals detected in groundwater at the site. Trichloroethene (TCE), cis-1,2 dichloroethene (DCE), and vinyl chloride are also present in groundwater; they are believed to represent breakdown products of the PCE. In many instances, groundwater concentrations of these chemicals were significantly greater than permissible limits for drinking water, designated Maximum Contaminant Levels (MCLs), set under the federal Safe Drinking Water Act. The chlorinated VOCs were found to be present extensively across Parcel B and the western portion of Parcel A. During the RI, groundwater sampling revealed the following:

- PCE was detected in 44 out of 78 groundwater samples, ranging from 0.2 to 11,000 μg/L. The MCL for PCE is 5 μg/L.
- TCE was detected in 53 out of 78 groundwater samples, ranging from 0.2 to 1,900 μg/L. The MCL for TCE is 5 μg/L.
- Cis-1,2-DCE was detected in 59 out of 78 samples, ranging from 0.4 to 3,000 μg/L. The MCL for cis-1,2-DCE is 70 μg/L.
- Vinyl chloride was detected in 44 out of 84 samples, ranging from 0.6 to 340 μg/L. The MCL for vinyl chloride is 2μg/L.

Dense nonaqueous phase liquids (DNAPLs) were not observed in any of the monitoring wells at the site.

Post-RI groundwater sampling results are consistent with the results of the RI groundwater sampling, although maximum concentrations of VOCs have decreased. VOC concentrations in groundwater measured in 2000 are shown on **Figure 5-9**. Historical VOC concentrations for 1997, 1999 and 2000 are shown in **Figures 5-10 and 5-11.**

Four groundwater plumes of PCE and its breakdown products in the shallow upper aquifer were identified through the various groundwater investigations. The areal extent of PCE in groundwater based on the 2000 monitoring results shown is shown in **Figure 5-12.** Three plumes originate in the southeast corner, the southwest corner and near Plant 3 on Parcel B. The 1,500-foot plume arising at Plant 3 has the highest levels of PCE detected (11,000 μg/L in 1997) in the groundwater at the site. A fourth plume of PCE-containing groundwater also exists on the western (ODOT) lot of Parcel A and appears to be comingled with the plume arising from Plant 3. The source of plume 4 is unknown, and the 2000 soil exploration of the suspected source area did not detect chlorinated VOCs. No further investigation to locate the potential source of Plume 4 is planned, since EPA plans to address the groundwater plume with response actions in this ROD. The concentrations of chlorinated solvents decrease with depth in the upper aquifer, although VOC concentrations exceed drinking water standards at depths up to 50 feet bgs. The shallow portion (0 to 20 feet bgs) of the upper aquifer is most impacted by the chlorinated solvents. None of the plumes of contaminated groundwater have moved off the site to date.

Concentrations of PCE above safe drinking water standards were intermittently detected in the artesian industrial well IW-01 screened in the lower aquifer on the ODOT property. The PCE in this well, IW-01, is believed for several reasons to originate from an off-site source rather than from contaminated groundwater at the Northwest Pipe & Casing Company / Hall Process Company site. First, testing during the RI showed that the upper aquifer does not appear to be hydraulically connected or flowing freely to the lower aquifer in the immediate vicinity of the Northwest Pipe & Casing Company / Hall Process Company site. Also, VOCs were absent in the deepest portion of the upper aquifer on the NWPC site, indicating that this part of the upper aquifer was not transferring VOCs to the underlying lower aquifer Further groundwater investigation at the site in 2000 did not result in more conclusive information on the source of PCE detected at the ODOT well in the lower aquifer. DEQ has identified other sites with groundwater contamination in the vicinity of Northwest Pipe and Casing Company; these sites have not been ruled out as a possible source of the PCE contamination in the lower aquifer at ODOT. DEQ is working with those site owners on groundwater investigations.

Other contaminants were found to a limited degree in site groundwater. PAHs, principally acenapthalene, fluoranthene, and naphthalene were detected at low concentrations in limited locations in the shallow part of the upper aquifer groundwater (PAHs are one of the principal contaminants of soil at the site.) These groundwater concentrations were markedly lower than levels measured during a previous field investigation in 1990. Inorganic constituents such as metals were detected in groundwater on site at relatively low concentrations, although the levels were higher than in up gradient samples; however, no distinct plumes were recognized.

5.6.2 Chemicals of Potential Concern (COPCs)

Of the chemicals identified in groundwater at the site (Section 5.6.1), those which could pose a threat to human health or the environment are identified as COPCs for further evaluation in the baseline risk assessment (Section 6.0). Following the baseline risk assessment, groundwater contaminants of concern (COCs) were selected from the list of COPCs, based on potential human exposures at the site, to represent the specific chemicals of concern for which remedial action objectives and remediation goals are established. This process is further explained in Section 7.

COPCs were selected by a screening process that compared the maximum detected chemical concentrations to risk-based concentrations on a medium-by-medium basis. The risk-based concentrations used were the preliminary remediation goals (PRGs) calculated by EPA Region IX, and were based on standard default exposure assumptions for residential exposure. The Region IX PRGs are protective of human health at the 1×10^{-6} excess cancer risk level and the noncancer hazard quotient of one.

Chemicals detected at the site were screened out if, they were detected less than 5 percent of samples, they were present below background concentrations, they were considered an essential nutrient for which there is no risk-based concentration available, or there is no risk-based concentration available. This screening process is described in more detail in the human health risk assessment in Section 6.0.

The list of COPCs selected for groundwater at the Northwest Pipe and Casing Company site is presented in **Table 5-1.** The principal COPCs in groundwater are VOCs and inorganics.

5.6.3 Contaminant Fate and Transport

This subsection discusses the physical-chemical properties of the groundwater COPCs and contaminant transport pathways likely present at the site.

5.6.3.1 Potential Sources of Groundwater Contaminants

A number of historical and continuing sources of contamination to groundwater at the Northwest Pipe & Casing site are possible, including:

- Historical direct release, spills, and disposal/burial of waste coal tar and solvents.
- Historical direct release of process wastewater from the facility.
- Historical disposal of debris.
- Historical and continuing transport by surface water infiltration and leaching of contaminated soil to groundwater.
- Historical and continuing transport by groundwater leaching of coal tar and solvent-contaminated subsurface soils buried within the saturated zone.

5.6.3.2 Uses and Properties of Groundwater Contaminants

Chlorinated solvents such as PCE and TCE have been extensively used in industry as degreasing and cleaning solvents. Records supplied by Southern Pacific Railroad show large quantities of PCE were delivered to the Northwest Pipe and Casing Company site during historical pipe coating operations. TCE and cis-1,2-DCE likely were not used at the site since groundwater concentrations are an order of magnitude lower than those found for PCE. TCE and cis-1,2-DCE may have been present as minor constituents in the technical grade PCE commonly used, or may result from the anaerobic biodegradation of PCE. PCE and TCE are volatile liquids at room temperature with densities greater than water If volumes of PCE and/or TCE released to the environment are greater than the adsorptive capacity of the soil, they will migrate downward through soil under the influence of gravity.

5.6.3.3 Fate and Transport of Primary Contaminants

Contaminant adsorption to soil, partitioning between soil and water, and dissolution to water are closely related processes which can influence contaminant migration. Compounds adsorbed to soil can undergo leaching and dissolution by infiltrating rain, surface water, or in the saturated zone, by groundwater moving through a contaminated area.

As coal tar weathers in the soil environment, the more soluble LPAHs, such as naphthalene, phenanthrene and anthracene, and phenolic components will migrate from the mixture, making it more tar-like and less mobile HPAHs and PCBs are strongly adsorbed to soil, and therefore will not be released readily or in large concentrations when in contact with water. Although some dissolution will occur over time, migration of dissolved HPAHs and PCBs is unlikely due to their large soil/water partition ratios The HPAHs and PCBs will be preferentially adsorbed by soil, retarding their migration in the environment

Chlorinated solvents have lower soil/water partition ratios, indicating these compounds are less strongly sorbed to soil and, therefore, preferentially leach or dissolve into the groundwater. Similarly, the dissolution of chlorinated solvents leached into groundwater likely will not be significantly retarded as they move through soil, and so these solvents may continue to migrate.

Volatilization of PCE, TCE, DCE and vinyl chloride from soil, particularly for surface or near-surface contamination, is likely to be significant since these chlorinated solvents have relatively high vapor pressure. Henry's law partition coefficients for these volatile compounds are relatively high, indicating transfer of dissolved contaminants from water to interstitial soil vapor is likely. PCE can undergo stepwise reductive dechlorination under anaerobic conditions. Generally, conditions at the Northwest Pipe and Casing Company are not conducive for reductive dechlorination of PCE in groundwater, due to the low levels of organic matter present in the upper gravel unit and the relatively high redox potentials; however, the distribution of PCE and its daughter products suggests that some level of reductive dechlorination has occurred at monitoring locations on the site. Other natural processes occurring which may be responsible for the decreasing VOC concentrations in groundwater observed over time at some monitoring wells include dispersion, dilution, absorption and chemical reactions with subsurface materials.

5.6.3.4 Site Conceptual Model

Potential migration pathways for contaminants in groundwater are summarized in the conceptual site model depicted in **Figure 5-13** Based on site characteristics and the discussion above, migration of chlorinated solvent contaminants, with some degree of retardation resulting from natural processes, may be expected to occur.

The main transport pathway for the PCE and its degradation products is most likely leaching to groundwater from soil and/or buried sources and migration downgradient with groundwater flow. This is confirmed by the occurrence of PCE and its degradation products in groundwater on a significant portion of the site. Since adsorption and retardation for VOCs in soil are relatively low, eventual off-site migration of VOC-contaminated groundwater is possible. A secondary VOC transport pathway is evaporation to the atmosphere but this is probably significant only for areas of shallow soil contamination and the shallow portion of the upper aquifer. Seasonal discharge of shallow groundwater to the adjacent drainage channels is the primary pathway for groundwater VOCs to enter surface water

Exposure to VOC-contaminated groundwater could occur to future maintenance workers at the site if groundwater was used for irrigation/landscape maintenance. Future off-site residents could be exposed to VOC-contaminated groundwater if used for domestic purposes including drinking and bathing, or landscape irrigation.

Ecological exposure to VOC-contaminated groundwater migrating to surface water in the adjacent drainage channels could occur to aquatic invertebrates, fish and piscivorous birds.

The primary transport pathway for LPAHs is also likely to be leaching. Compared with PCE and its breakdown products, LPAHs migration will be significantly retarded due to their high adsorption coefficients. This is demonstrated by the very limited occurrence of PAHs in groundwater at the site

5.6.4 RCRA Hazardous Wastes

This subsection discusses the extent, if any, to which groundwater at the Northwest Pipe and Casing Company site may contain hazardous wastes under Subtitle C of the federal Resource Conservation and Recovery Act (RCRA). Subtitle C of RCRA establishes a system for the management of hazardous wastes.

There is only limited information of a general nature available to EPA on the source of the waste materials generated by past pipe coating and related operations of the Northwest Pipe and Casing Company and the Hall Process Company at the site. Based on the lack of verifiable information, EPA is able to assert affirmatively that groundwater contamination of the Northwest Pipe and Casing Company site is not from RCRA-listed hazardous wastes.

Table 5-1
Human Health Contaminants of Potential Concern (COPCs) in Groundwater

COPC	COPC
Arsenic	cis-1,2-Dichloroethene
Cadmium	Tetrachloroethene
Iron	1,1,2-Trichloroethane
Lead	Trichloroethene
Manganese	Vinyl chloride
Mercury	bis(2-ethylhexyl)phthalate
Thallium	Dibenzofuran
Acetone	2-Methylnaphthalene
Benzene	Acenaphthene
Carbon Tetrachloride	Acenaphthylene
Chloroform	Fluorene
1,1-Dichloroethene	Phenanthrene
	Pyrene

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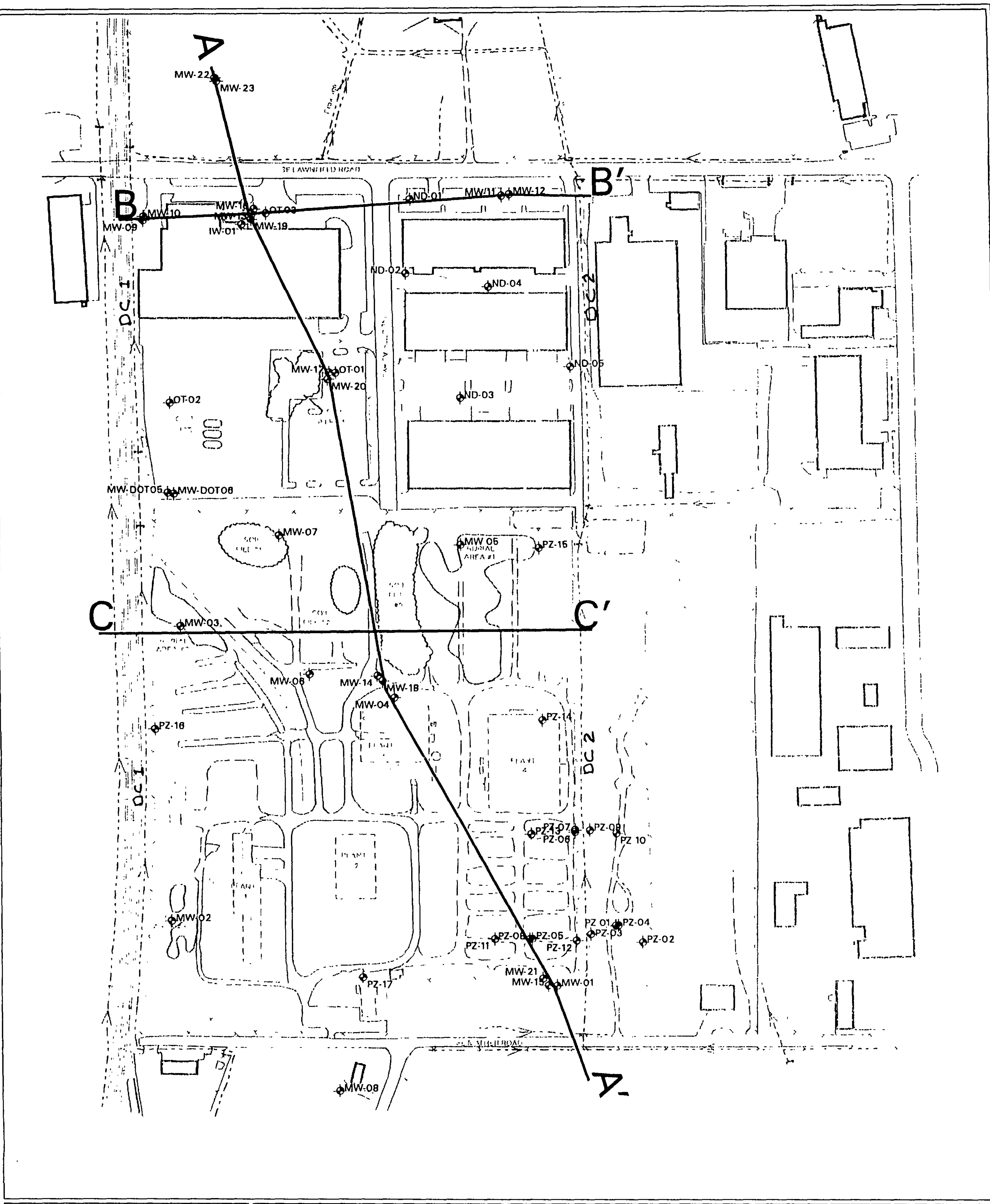


BASEMAP EXPLANATION

- Paved road
- Soil pile/Burial area/UST
- Building
- Railroad
- Fence
- Unpaved road
- Former plant location
- Drainage channel
- Concrete pad/foundation

SYMBOL EXPLANATION

- Subsurface soil exploration
- Cross-section line

SCALE 1 2900

50 0 50 100 150 200

Feet

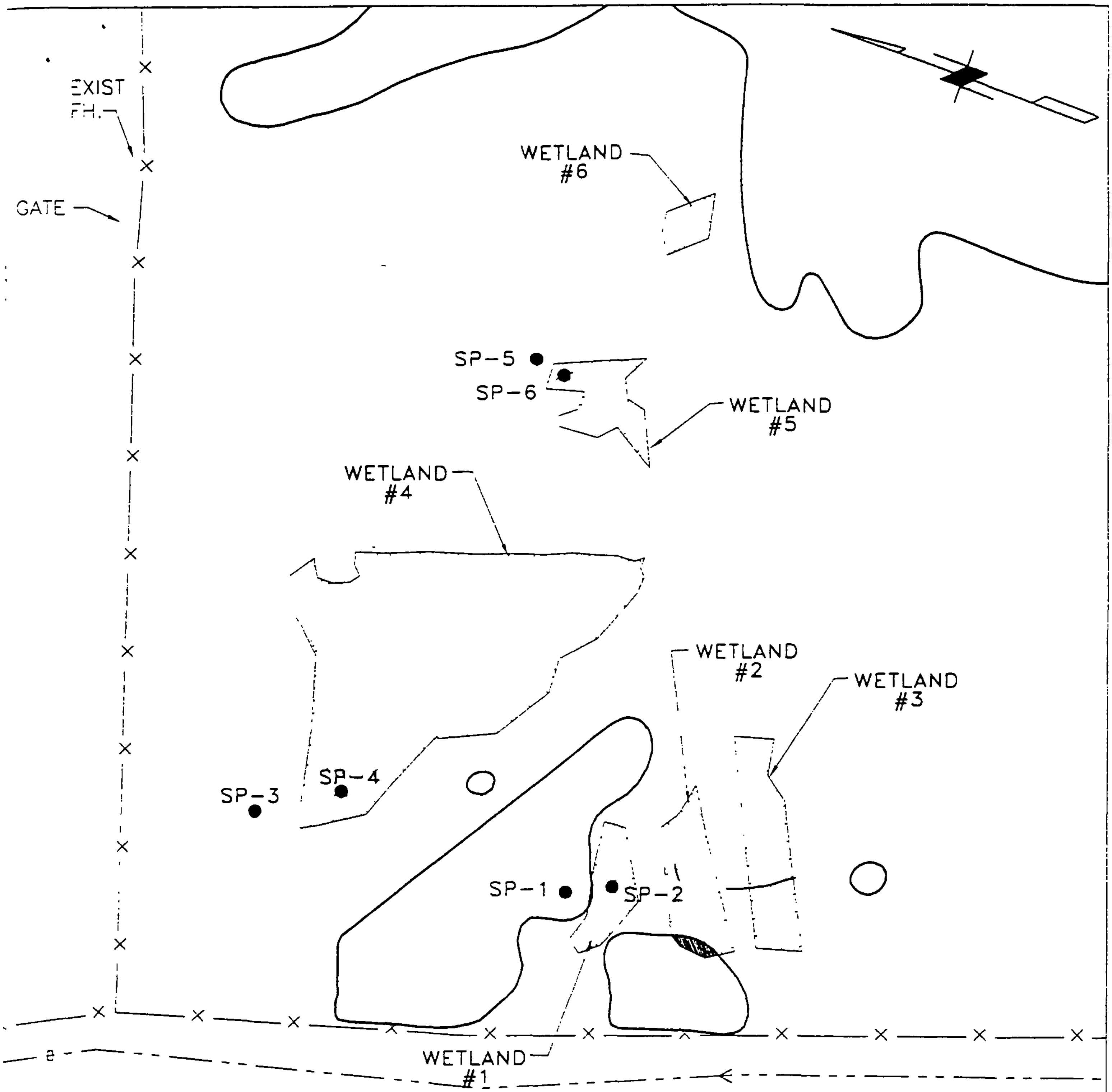
NOTES

WESTON

DATE April 22, 1998 4 12 PM
JOB NUMBER 04000-036-001-7100-00
VIEW FILE crosssect view
CHECKED BY: ______________
APPROVED BY: ______________

NWP&C RI: Location of Cross-Sections A-A', B-B', and C-C'

Figure 5-1



LEGEND

REMEDIAL ACTIONS EXCAVATION AREAS

WETLANDS 1 ACRE

WETLANDS IMPACTS (WETLANDS THAT LIE WITHIN EXCAVATION AREA) 261 FT^2

0 100 200

SCALE IN FEET

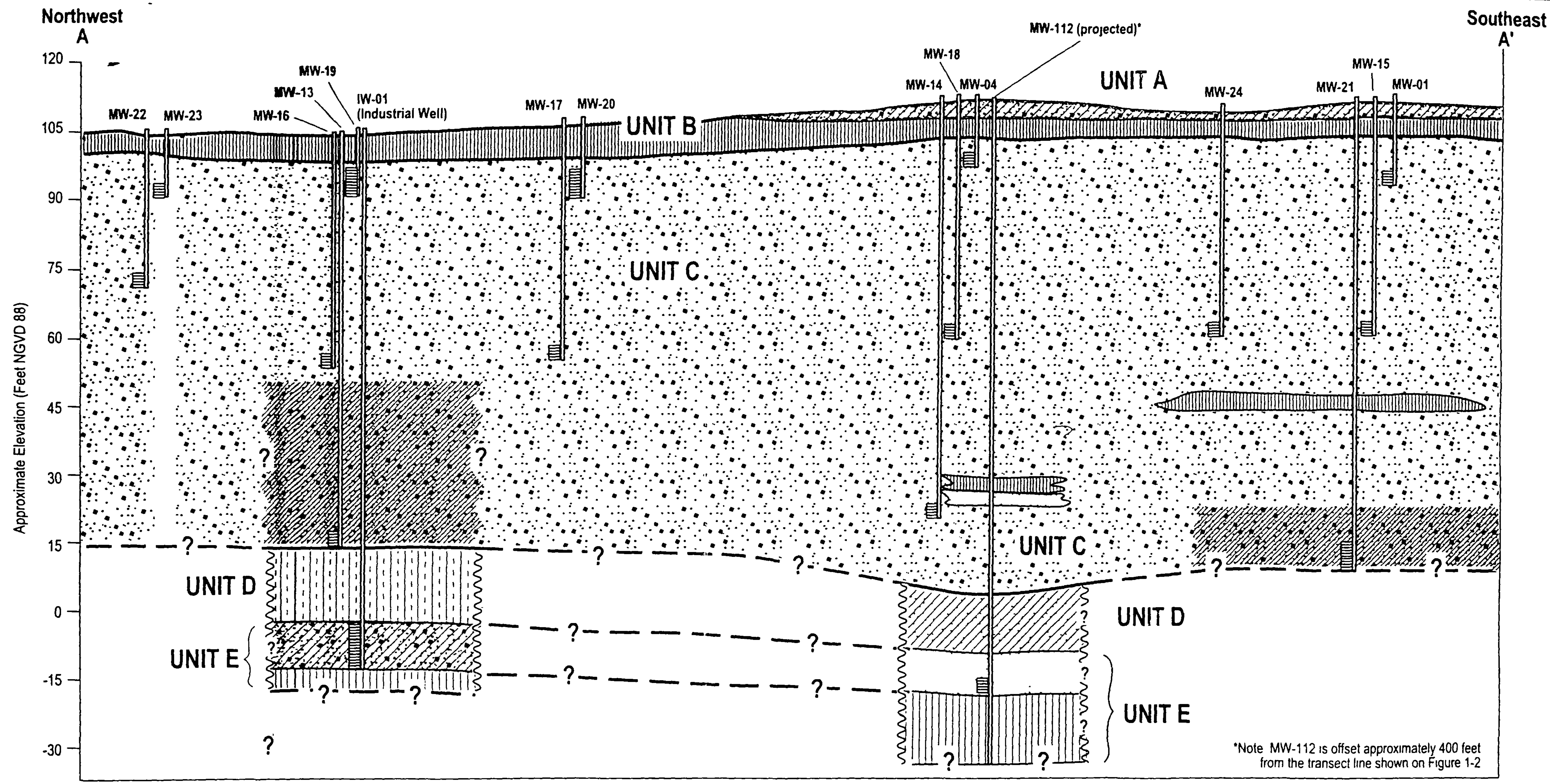
Location of Delinated Wetlands

May 2001
53-F4007100 03 8000

NW Pipe & Casing
EPA Region 10
Portland, Oregon

URS

Figure 5-2



Modified from RI Figure 3 4 (USEPA 1998)

SYMBOLS

- Cementation
- Exploration Boring Showing Screen Interval
- -?- Contact Between Units (queried where inferred)
- MW-22 Monitoring Well ID

GEOLOGIC UNITS

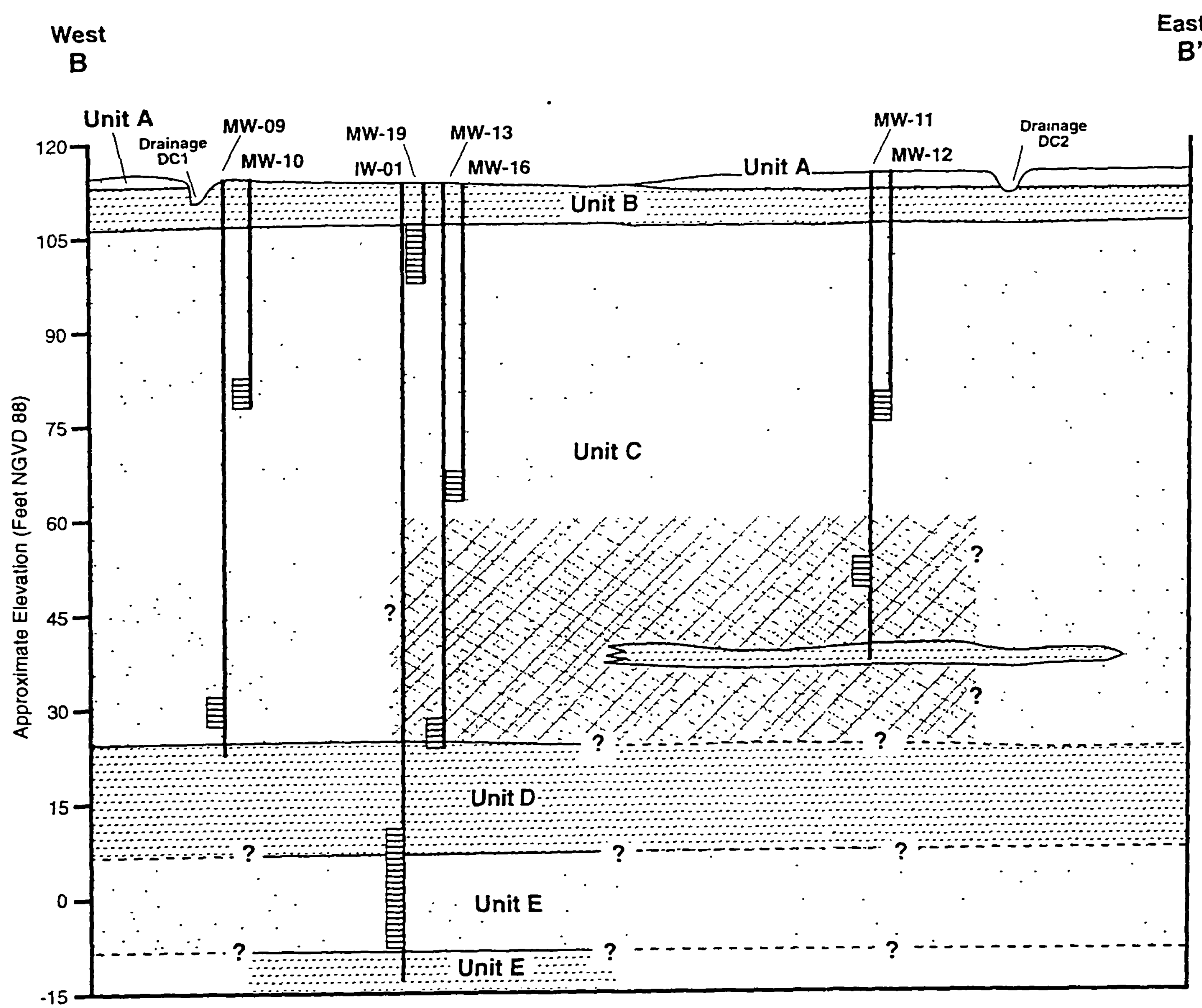
- **A** Silty gravel, fill
- **B** Plastic silt with/without sand and gravel (recent alluvium)
- **C** Coarse gravel, variable silt matrix, variable cemented coarse gravel, interspersed lenses of silt and sand (Pleistocene cataclysmic flood deposits)
- **D** Clayey silt ("Blueclay")* to silty sand (Plio-Pleistocene Troutdale Formation)
- **E** Interbedded sandy gravel and sand (Plio-Pleistocene Troutdale Formation)
  Hard silt with/without clay and sand (Plio-Pleistocene Troutdale Formation)

*Driller's description IW-01 (installed 1977)

0 100 200
Approximate Scale in Feet
Vertical Exaggeration Approximately 10X

Figure 5-3
Schematic Geologic Cross Section A - A'

030-RI-CO-10G8
Northwest Pipe and Casing
GROUNDWATER MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM



EXPLANATION

Geologic Units

A — Silty Gravel (Fill)

B — Upper Silt
- Elastic Silt with/without Sand and Gravel (Recent Alluvium)

C — Upper Gravel
- Coarse Gravel, Variable Silt Matrix, Discontinuous Sandy and Silt Interbeds (Pliestocene Cataclysmic Flood Deposits)
- Variable Cemented Coarse Gravel, Discontinuous Sandy and Silt Interbeds (Plio-Pliestocene Troutdale Formation?)

D — Lower Silt
- Hard Silt with/without Clay and Sand (Plio-Pliestocene Troutdale Formation)

E — Lower Gravel
- Interbedded Gravel, Sand, and Silt/Clay (Plio-Pliestocene Troutdale Formation)

Lithologies

Gravel with/without Sand and Silt

Silt with/without Sand and Clay

Cementation

MW-10 Monitoring Well ID

—?— Contact between Units (Queried where Inferred)

Exploration Boring showing Screen Interval

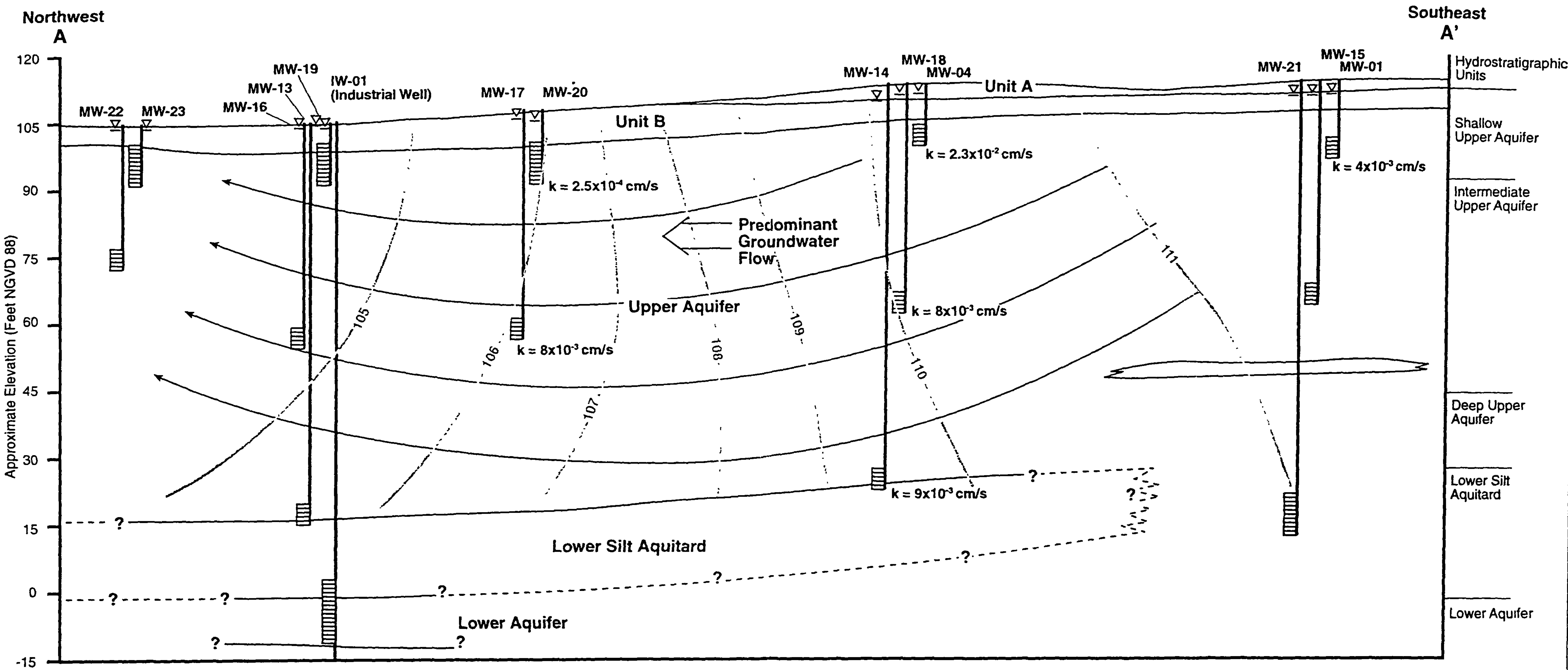
0 100 200
Scale in Feet
Vertical Exaggeration Approximately 10X

WESTON

Northwest Pipe & Casing RI
Geologic Section B-B'

Figure 5-4

98-0204 Fig3-5.fh8



Note: Groundwater elevations based on 16 February 1998
water level measurements

0 100 200
Scale in Feet
Vertical Exaggeration
Approximately 10X

WESTON

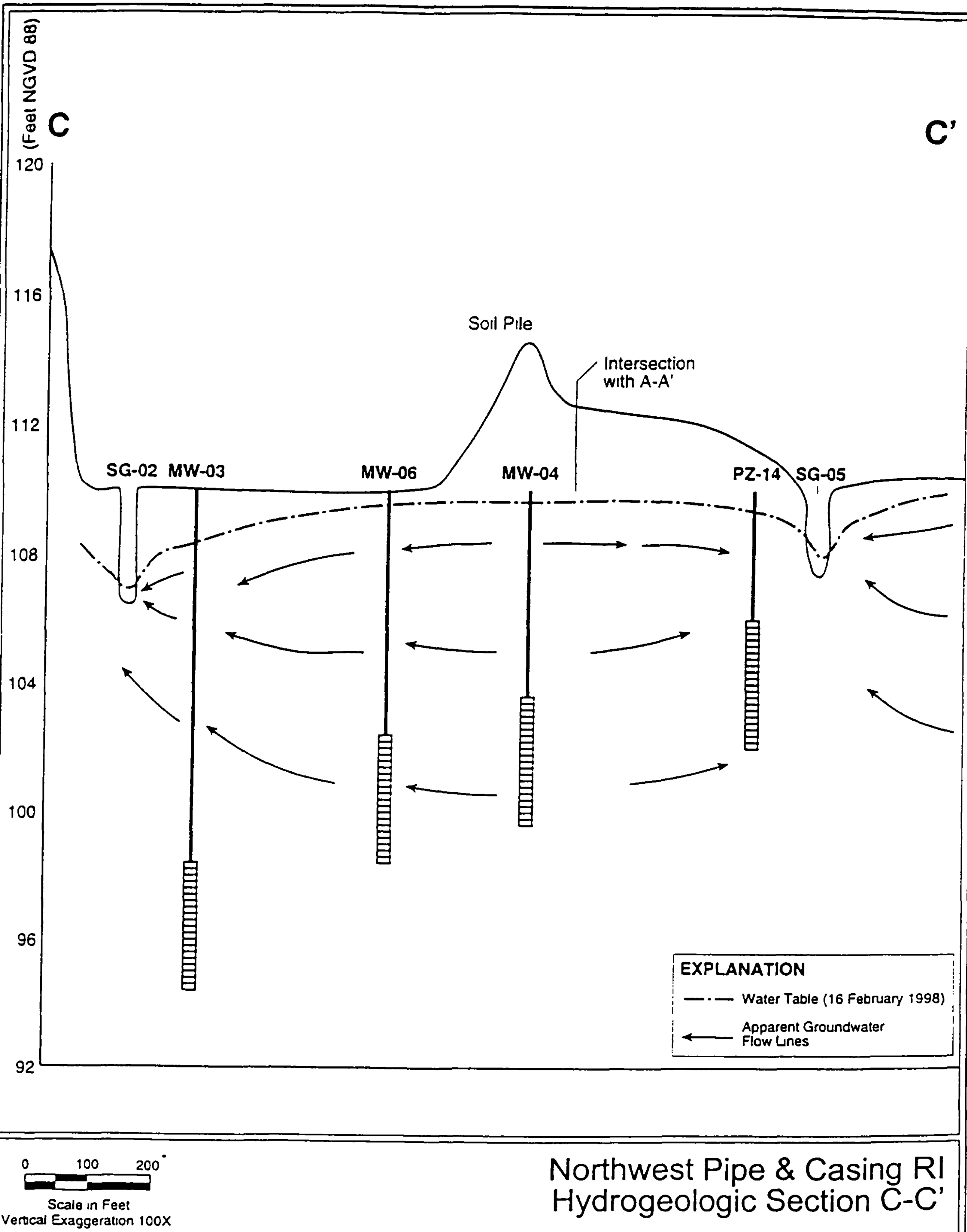
EXPLANATION

←	Groundwater Flow Lines
—104—	Line of Equalpotential
▽	Groundwater Level
k = 9×10^{-3} cm/s	Hydraulic Conductivity

Northwest Pipe & Casing RI
Hydrogeologic Section A - A'

Figure
5-5

98-0259 Fig3-5.fh8

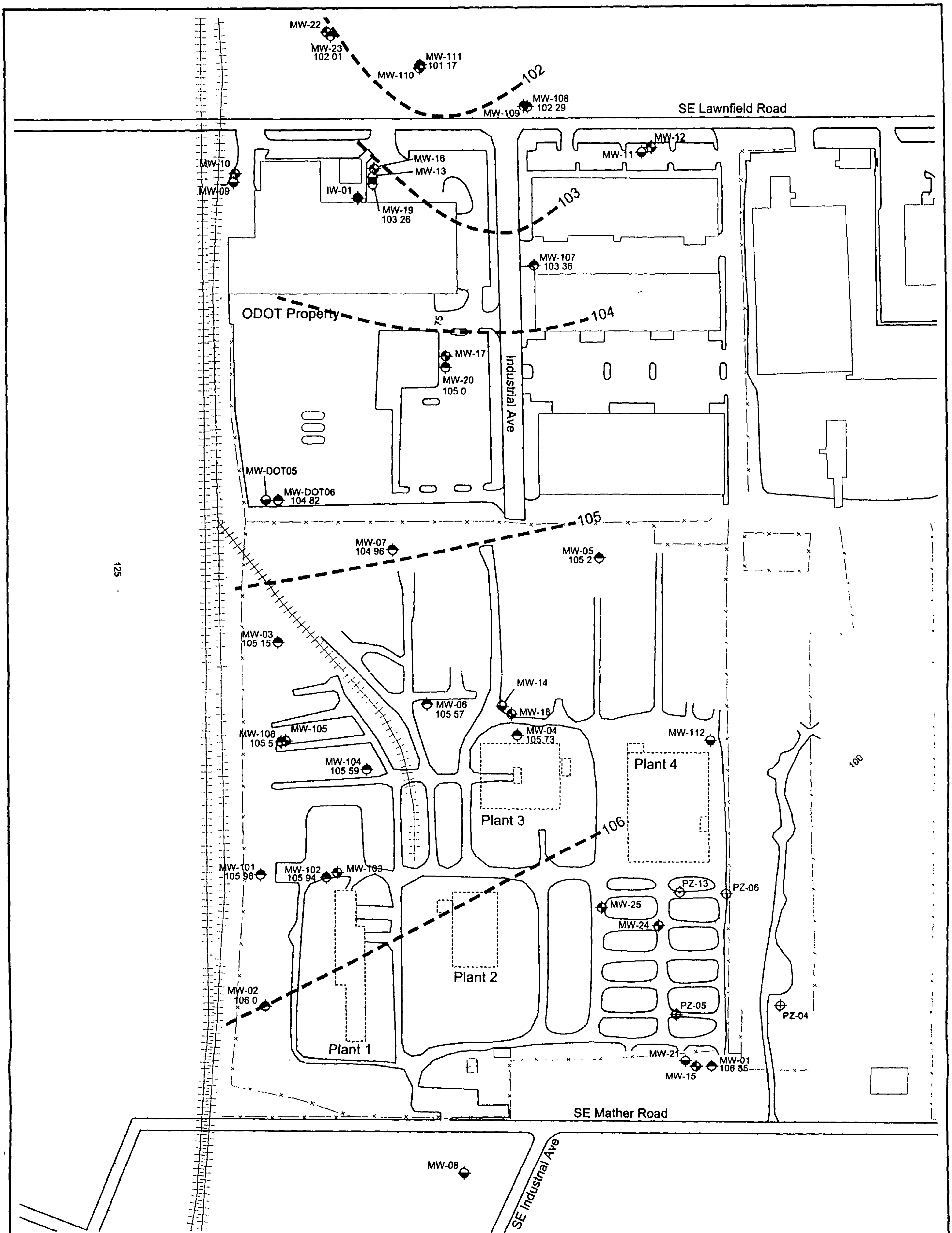


WESTON

98-0259 Fig3-8 FH8

Northwest Pipe & Casing RI
Hydrogeologic Section C-C'

Figure
5-6



LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Groundwater Contour (feet)
- 105 71 Groundwater Elevation (feet)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)

Figure 5-7
Groundwater Elevations and Contours
Shallow Upper Aquifer
(August 22, 2000)

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM

FILENAME T \RAC\NWP&C\Sub-Tasks\Annual GW 2000\GW-3 dwg

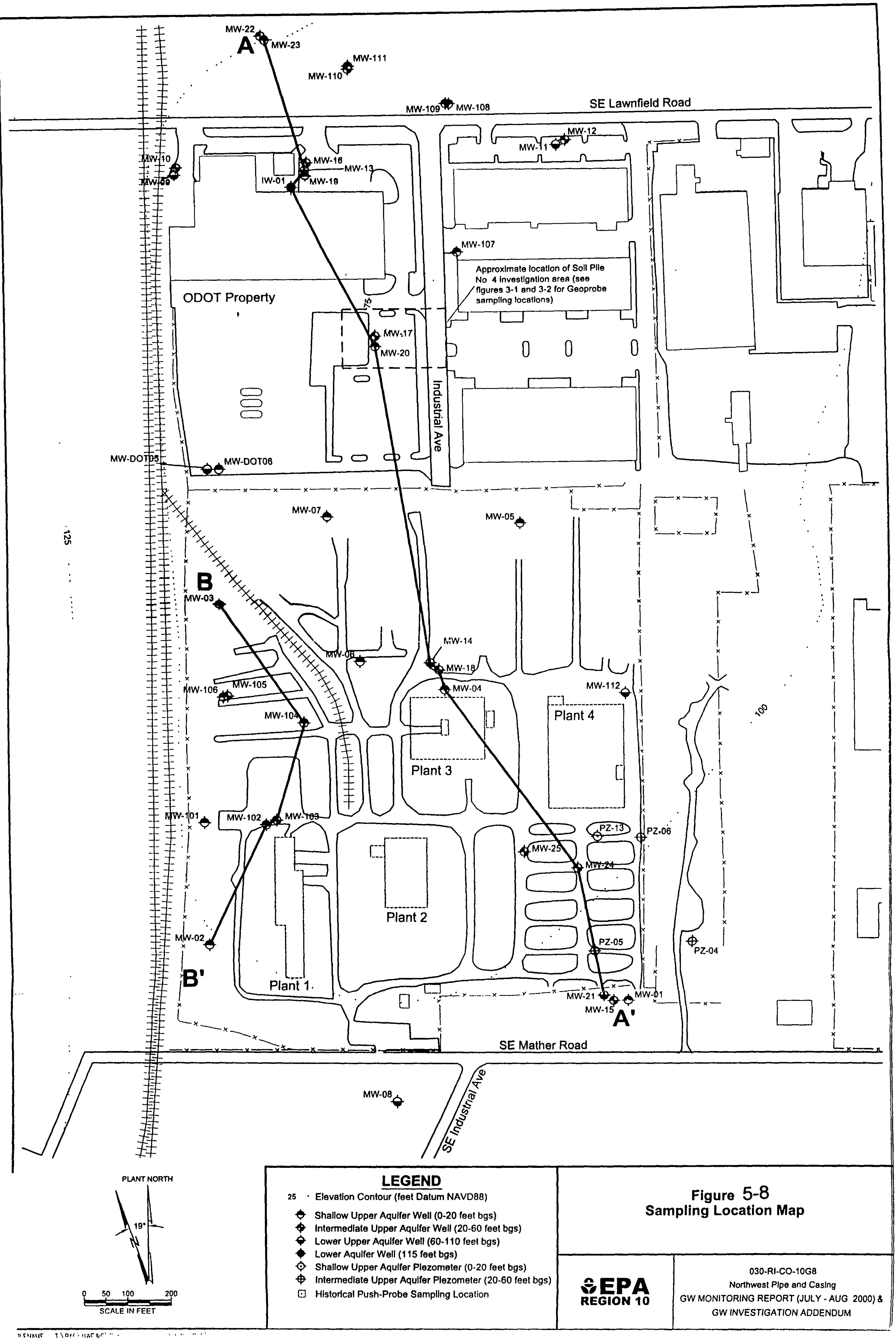
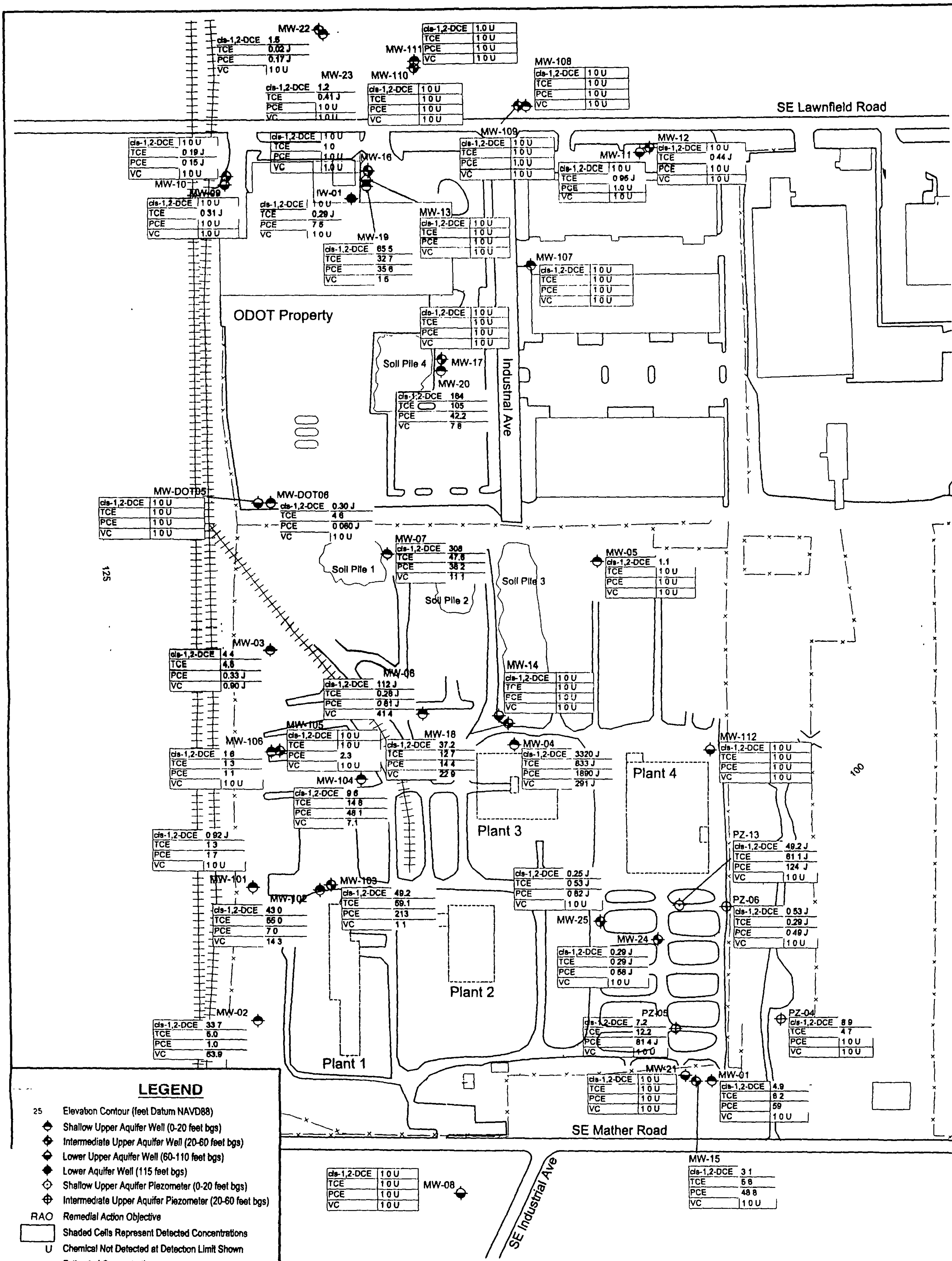


Figure 5-8
Sampling Location Map

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM



LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- RAO Remedial Action Objective
- Shaded Cells Represent Detected Concentrations
- U Chemical Not Detected at Detection Limit Shown
- J Estimated Concentration
- D Concentration Determined After Dilution of Sample

VOC Chemical Concentrations in Groundwater

cis-1,2-DCE	1.0 U
TCE	1.0 U
PCE	1.0 U
VC	1.0 U

Concentrations (ug/L)

Remedial Action Objectives

TCE	1.6 ug/L
PCE	0.9 ug/L
VC	0.02 ug/L

PLANT NORTH

19°

0 50 100 200

SCALE IN FEET

Figure 5-9
VOC Concentrations in Groundwater in 2000

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM

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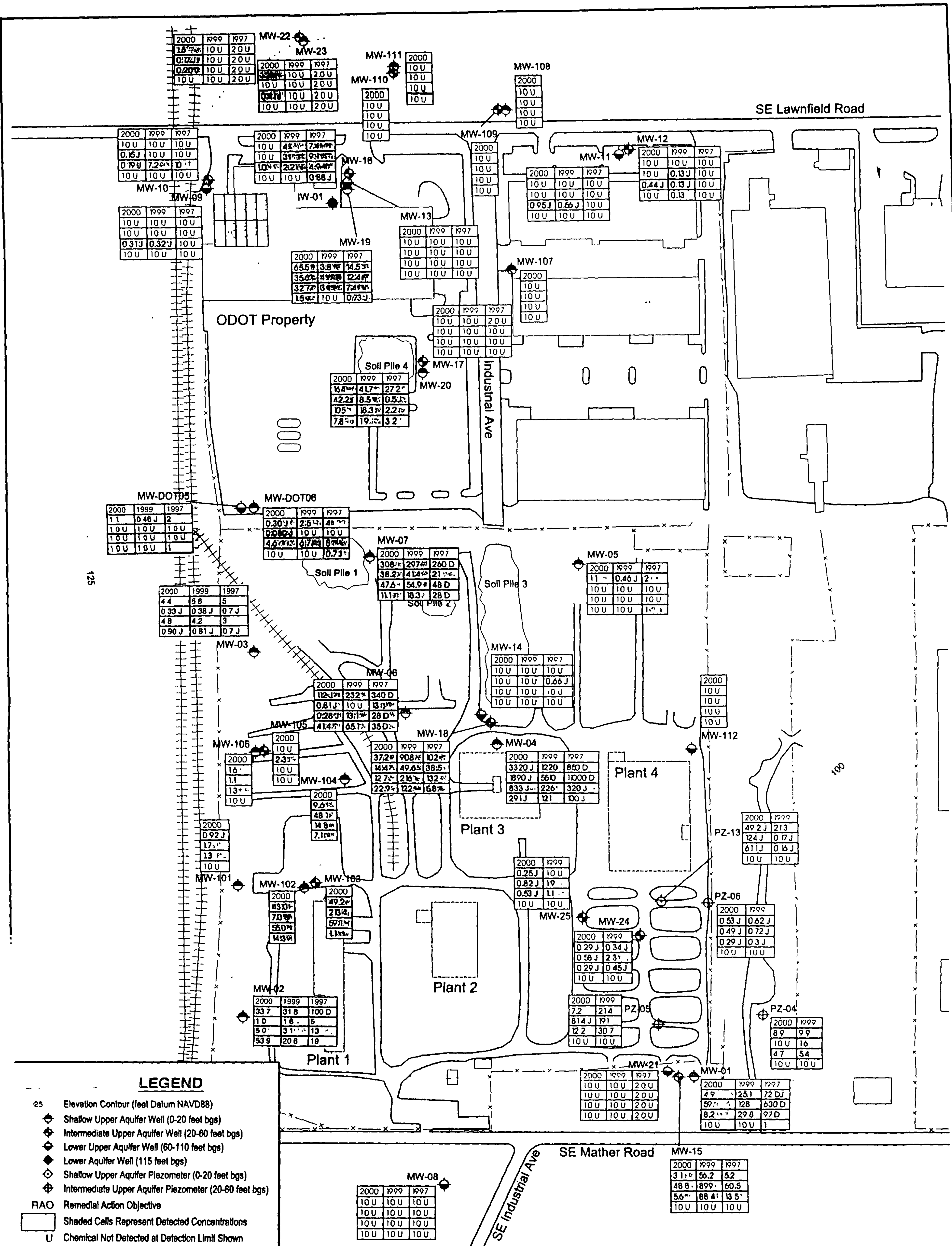


LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- RAO Remedial Action Objective
- Shaded Cells Represent Detected Concentrations
- U Chemical Not Detected at Detection Limit Shown
- J Estimated Concentration
- D Concentration Determined After Dilution of Sample

VOC Concentrations in Groundwater

	2000	1999	1997
cis-1,2-DCE	10 U	10 U	10 U
PCE	10 U	10 U	10 U
TCE	10 U	10 U	10 U
VC	10 U	10 U	10 U

— Sampling Year

Concentrations (ug/L)

Remedial Action Objectives

TCE	1 6 ug/L
PCE	0 9 ug/L
VC	0 02 ug/L

PLANT NORTH

19°

0 50 100 200

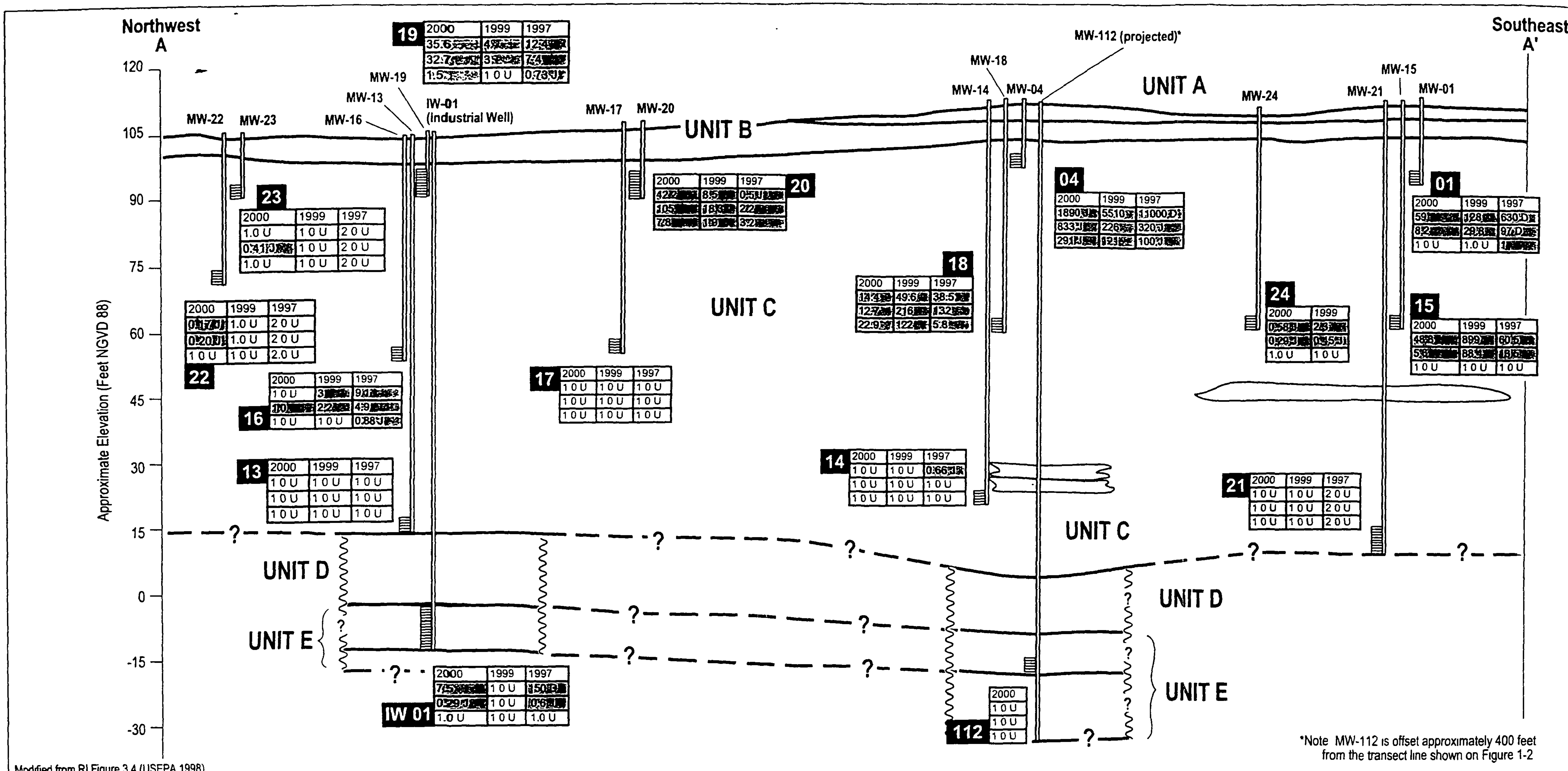
SCALE IN FEET

Figure 5-10
VOC Concentrations in Groundwater in 1997, 1999 and 2000

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) & GW INVESTIGATION ADDENDUM

NAME. T:\RAC\NWP&C\Sub-Tasks\Annual GW 2000\GW-5A.DWG
DATE 12/20/00 AT 17:01



SYMBOLS

Exploration Boring Showing Screen Interval

? Contact Between Units (queried where inferred)

MW-22 Monitoring Well ID

Well Number

Year

Groundwater Concentrations (ug/L)

PCE

TCE

VC

U - Chemical not detected at detection limit shown

J - Estimated concentration

D - The concentration was determined after dilution of the sample

Shaded cells indicate detected values

GEOLOGIC UNITS

A Silty gravel, fill

B Plastic silt with/without sand and gravel (recent alluvium)

C Coarse gravel, variable silt matrix, variable cemented coarse gravel, interspersed lenses of silt and sand (Pleistocene cataclysmic flood deposits)

D Clayey silt ("Blueclay")* to silty sand (Plio-Pleistocene Troutdale Formation)

E Interbedded sandy gravel and sand (Plio-Pleistocene Troutdale Formation)

Hard silt with/without clay and sand (Plio-Pleistocene Troutdale Formation)

*Driller's description IW-01 (installed 1977)

0 100 200

Approximate Scale in Feet

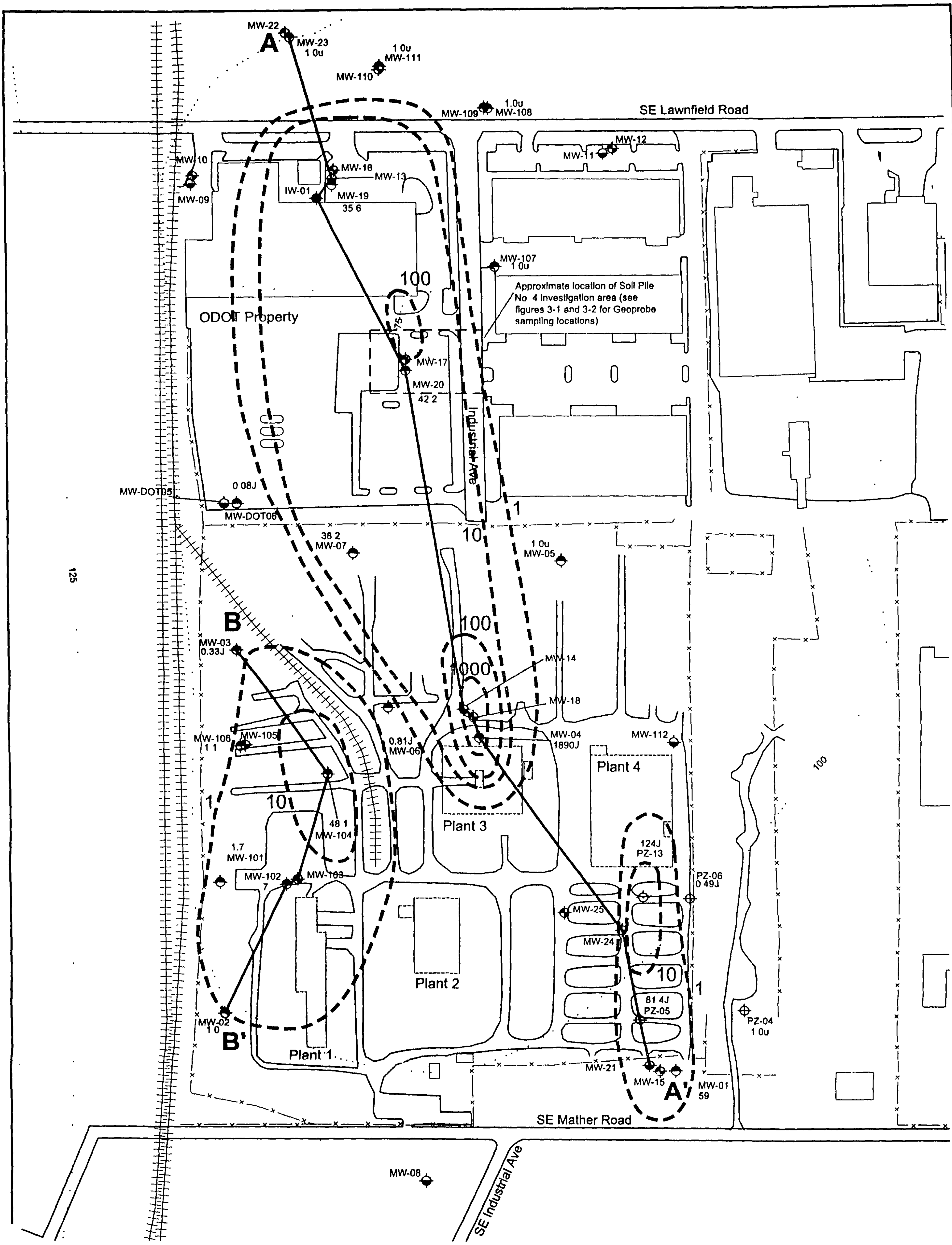
Vertical Exaggeration Approximately10X

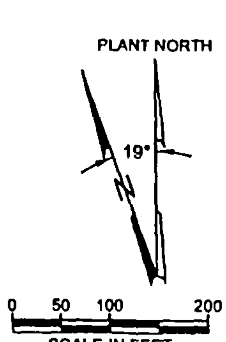
Figure 5-11
Schematic Geologic Cross Section A - A' Showing VOC Concentrations

030-RI-CO-10G8

Northwest Pipe and Casing

GROUNDWATER MONITORING REPORT (JULY - AUG 2000) & GW INVESTIGATION ADDENDUM





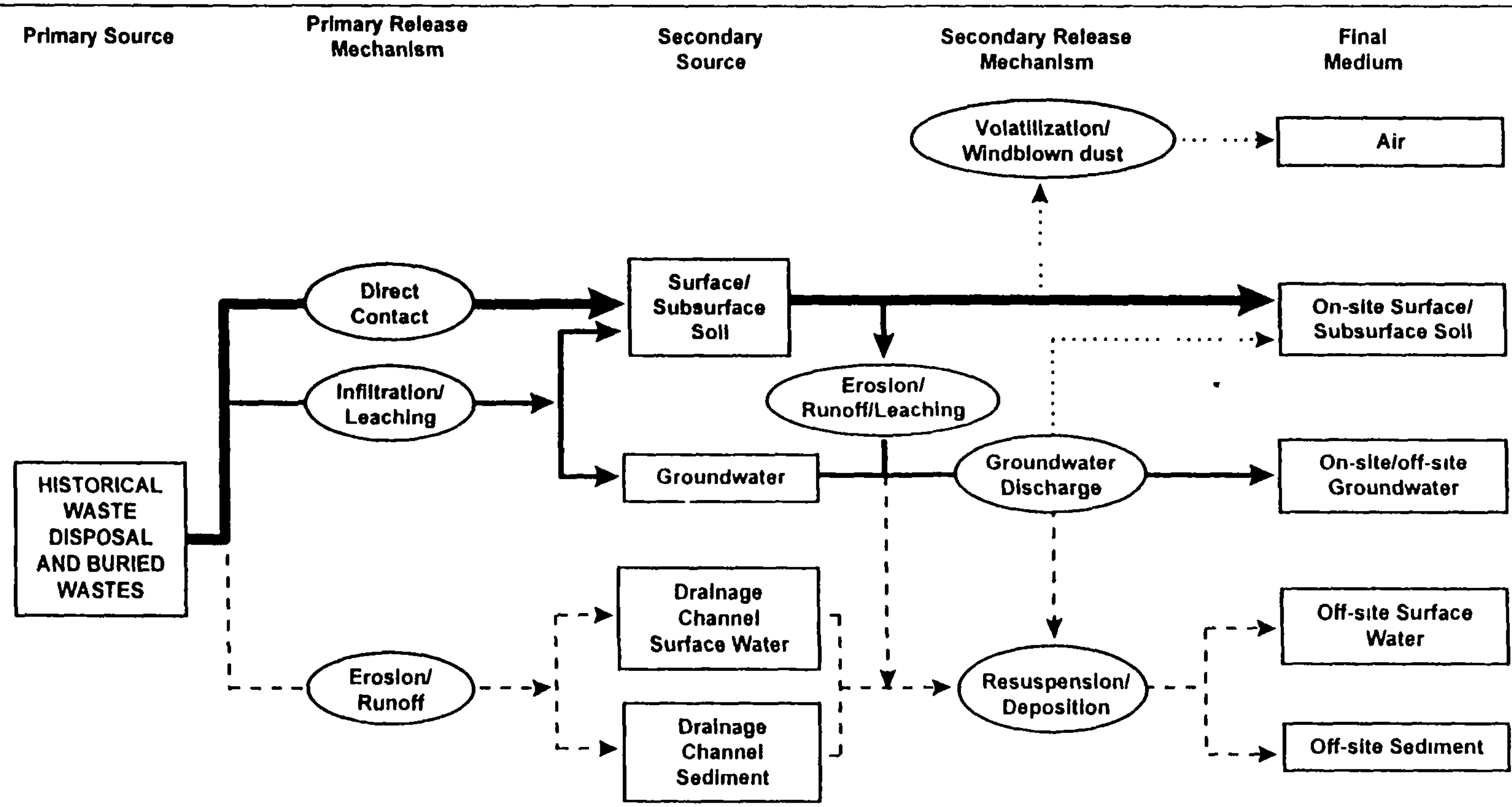
LEGEND

- ·25· Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Historical Push-Probe Sampling Location

Figure 5-12
2000 PCE
Concentrations and Contours
Shallow Upper Aquifer

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) & GW INVESTIGATION ADDENDUM



EXPLANATION

- Represents a primary migration pathway for VOCs, PAHs, and PCBs at the site
- Represents a secondary migration pathway for contaminants at the site
- Represents a primary migration pathway for VOCs at the site
- Represents a minor migration pathway at the site

Northwest Pipe & Casing RI
Conceptual Site Model

Figure
5-13

97-988 fig

6.0 SUMMARY OF SITE RISKS

6.1 INTRODUCTION

A baseline risk assessment[1] was conducted to evaluate the current and future human health and ecological risks associated with chemicals in groundwater at and in the vicinity of the Northwest Pipe and Casing Company site. The assessment serves as a baseline to indicate risks that could exist if no action was taken. The risk assessment takes into consideration potential risks if existing residential use patterns shift in the future and contaminated groundwater is used as drinking water in homes. The results of the baseline risk assessment are used to evaluate whether remedial action is needed.

The risk assessment followed the basic guidelines set by the EPA and current scientific data. A risk assessment evaluates the likelihood of adverse effects occurring in human or ecological populations potentially exposed to chemicals released in the environment. Risk assessments are not intended to predict actual risk to an individual. Instead, they provide upper-bound and central tendency estimates of risk with an adequate margin of safety, according to EPA guidelines, for the protection of virtually all receptors that may potentially come into contact with chemicals at the site.

6.2 CURRENT AND POTENTIAL FUTURE LAND AND GROUNDWATER USE

The NWPC site is currently zoned for light industrial use. Parcel B has been vacant since 1986. The ODOT-owned portion of Parcel A is occupied by an ODOT warehouse/office and an equipment maintenance facility/storage yard. The eastern portion of Parcel A houses the Clackamas Commerce Park, a three-building complex of commercial and light industry businesses.

Property adjacent and in proximity to the east and south of the site is used for a variety of industrial purposes, such as metal fabrication and equipment manufacturing. A large radio transmission tower complex operated by KEX radio occupies a large open field north of the site. The National Guard Camp Withycombe facility is located southeast of the site. The closest residence to the site is located approximately 500 feet to the southwest. A small residential area known as Hollywood Garden is located approximately one-half mile southeast from the site and south of Camp Withycombe. The residential area is served by a water utility for potable water.

[1]The baseline risk assessment evaluated risks from exposure to all environmental media at the site including soil, surface water and sediment, as well as groundwater The Soil OU ROD issued by EPA in June 2000 described the risks posed by all of these media, except for groundwater Since this ROD is for groundwater only, the description of site risks in this ROD is limited to risks from groundwater

The reasonably anticipated future land use at the site is expected to remain light industrial and/or commercial, based on zoning maps developed by the Clackamas County. A highway project designated the Sunrise Corridor is being evaluated by ODOT and could include highway lanes located on or above the NWPC site. If constructed the Sunrise Corridor project could affect future uses of portions of the site. As currently planned by ODOT, the Sunrise Corridor project would include a multi-lane interchange between Interstate 405 and Highway 224, which would go across the Northwest Pipe and Casing Company site along a northwest-to-southeast line. The interchange likely would be raised above the current grade of the site. ODOT has not secured funding for the project, and estimates that actual construction could be at least 10 years away.

Groundwater at and immediately downgradient from the site is not currently used for drinking water. Businesses and residences in the site vicinity are connected to Clackamas County Water District. However, the groundwater is considered to be a *potential* source of drinking water and therefore is classified as Class II groundwater under the "EPA Guidelines for Ground-Water Classification" Final Draft, December 1986. There are no known immediate plans for use of the groundwater at or in the vicinity of the site.

6.3 HUMAN HEALTH RISK ASSESSMENT

The human health risk assessment characterized *future* risks to humans from exposure to groundwater chemical contaminants detected at the site. *Current* risks to humans were not evaluated because EPA determined that there are no current users of groundwater at the site Under potential future use scenarios, exposures to maintenance workers at the site and off-site residents from contact with groundwater contaminants were evaluated. Off-site residential exposure to groundwater was evaluated for both adults and children assuming they would use impacted groundwater as their tap water source in their homes at some point in the future. A conceptual Site Exposure Model for the entire site is presented in **Figure 6-1**

No current human receptors were evaluated for groundwater exposure. Although transient residential populations have been observed in the past near the site and occasionally trespassing onto the site, the transients are not exposed to groundwater.[2] No other current populations are likely to be exposed to groundwater contaminants on a regular basis.

The risks posed by site groundwater to security patrol personnel were not evaluated in the baseline risk assessment because: 1) security personnel are not expected to be exposed to groundwater, and 2) the patrols are performed by vehicle, vs. on-foot, and 3) security personnel are required to comply with personal protection and safety requirements when conducting the patrols.

[2] Transient exposure to surface water in adjacent drainage ditches, which likely receives some seasonal inflow of VOC-contaminated groundwater from the shallow upper aquifer, was evaluated in the baseline risk assessment and described in the 2000 Soil OU ROD

Since Parcel B is likely to be redeveloped for light industrial or commercial use, the future on-site worker population was evaluated. Risks to a future on-site maintenance worker from exposure by ingestion and dermal contact with groundwater were evaluated.[3]

Risks to the future off-site resident, both adult and child, who may be exposed to groundwater contaminants through domestic use of the upper aquifer were evaluated. This scenario assumed that groundwater contaminants at the site would migrate to potential future local domestic wells immediately off-site in the same concentrations as they are found on-site. Risks from dermal contact, ingestion and inhalation of VOCs from groundwater were considered These risks, therefore, may be similar to the risks posed by the on-site residential use of groundwater (not currently allowed under current local land use zoning).

The primary components of the risk assessment include data evaluation, exposure assessment, toxicity assessment, and risk characterization, which are discussed in the following subsections

6.3.1 Data Evaluation

The initial step in the risk assessment is review of the available sampling results for each affected environmental medium (e.g., soil, groundwater) to identify a list of chemicals, referred to as the chemicals of potential concern (COPCs), to be carried through the remainder of the risk assessment. COPCs were selected by a screening process that compared the maximum detected chemical concentrations to risk-based concentrations on a medium-by-medium basis. The risk-based concentrations used were the preliminary remediation goals (PRGs) calculated by EPA Region IX, and were based on standard default exposure assumptions for residential exposure. The Region IX PRGs are protective of human health at the 1 X 10^{-6} excess cancer risk level and the noncancer hazard quotient of one. As explained earlier in section 5 5 2, this screening process eliminated some chemicals from evaluation in the risk assessment for reasons including low frequency of detection, present below background concentrations, or there was no risk-based level available for comparison.

The COPCs identified for groundwater at the Northwest Pipe and Casing Company site are presented in **Table 5-1**.

6.3.2 Exposure Assessment

An exposure assessment typically evaluates sources, pathways, receptors, exposure duration and frequency, and routes of exposure to assess total human exposure to the COPCs at the site. This assessment identified the populations potentially exposed to chemicals at the site, the means by which exposure occurs, and the amount of intake from the groundwater.

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[3] Risks from exposure to soil by incidental ingestion, inhalation of particulate and volatiles, and direct dermal contact were also evaluated under the baseline risk assessment and described in the Soil OU ROD

The result of this process is a calculated daily intake per body weight for groundwater. The daily intake rate per body weight (intake or administered dose) combines exposure parameters for the receptors of concern (e.g., contact rates, exposure frequency and duration) with chemical-specific toxicity criteria and exposure point concentrations (EPCs) for the media of concern, to arrive at an estimate of health risk.

To calculate human intake of chemicals, EPCs must be estimated. EPCs are those concentrations of each chemical to which an individual may potentially be exposed for each medium at the site. EPCs were developed from the analytical data obtained during the remedial investigation and from previous investigations at the site. EPCs were calculated for both average, or central tendency (CT), exposures and reasonable maximum exposures (RME) at the site.

The RME is an estimate of the highest exposure that is reasonably expected to occur at the site and thus may overestimate the actual risk for the majority of the population. The RME concentration was calculated as the lesser of the maximum detected concentration or the 95 percent upper confidence limit (UCL) on the arithmetic mean, using half the sample detection limit for non-detected chemicals.

The CT estimate is defined as the average of typical exposures for that population Calculations of a more "typical" exposure are designed to approximate more average exposures at the site. Each average exposure point concentration was calculated as an arithmetic average of the chemical results for a particular medium, using half the sample detection limit for non-detected chemicals. The average exposure scenario was evaluated to allow comparison with the RME scenario. **Table 6-1** presents the EPCs calculated for groundwater COPCs.

The exposure parameters used in the risk assessment to calculate the intake of site chemicals in terms of a daily dose per body weight are presented in **Tables 6-2 and 6-3.**

For the risk assessment, the populations of concern for exposures to site groundwater contaminants include hypothetical off-site residents (both adult and child) using the impacted groundwater as a tap water source in the future, and future on-site maintenance workers conducting general grounds-maintenance activities. Currently, no off-site residents are using the impacted groundwater as a water supply source in their households. In summary, the following pathways and routes of exposure to groundwater were quantitatively evaluated in the risk assessment·

- Exposures to an on-site maintenance worker through ingestion, dermal contact and inhalation (of volatiles) of groundwater; and

- Exposures to off-site adult and child residents through indoor use of impacted groundwater by ingestion, dermal contact and inhalation (of volatiles)

6.3.3 Toxicity Assessment

The toxicity assessment identified the carcinogenic and noncarcinogenic human health effects associated with the COPCs and provided toxicity values that were used to calculate the dose-response relationship. The toxicity values describe the quantitative relationship between the level of exposure (dose) to a chemical and the increased likelihood of adverse impacts (response). The intake factors calculated in the exposure assessment section were combined with toxicity values and chemical concentrations to estimate a cancer risk or a noncancer hazard.

Key dose-response criteria used by EPA are cancer slope factors (CSFs) for assessing cancer risks and EPA-verified reference dose (RfD) values for evaluating noncancer effects. Toxicity values are derived from either epidemiological or animal studies, to which uncertainty factors are applied These uncertainty factors account for variability among individuals, as well as for the use of animal data to predict effects on humans. Sources of these toxicity values are the EPA online database Integrated Risk Information System (IRIS) and EPA's Health Effects Assessment Summary Tables (HEAST).

The CSF is multiplied by the estimated daily intake rate of a potential carcinogen to provide an upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. CSFs are expressed in units of mg/kg-day^{-1}. The upper-bound estimate reflects the conservative estimate of risks calculated from the CSF. This approach makes underestimation of the cancer risk unlikely This chemical-induced risk calculated based on the CSF is in addition to the risk of developing cancer due to other causes over a lifetime. Consequently, the risk estimates in this risk assessment are referred to as incremental or *excess* lifetime cancer risks. Cancer toxicity values for groundwater COPCs for ingestion/dermal and inhalation exposures are shown in **Tables 6-4 and 6-5**, respectively.

The chronic RfD, expressed in units of mg/kg-day, is an estimated daily chemical intake rate for the human population, including sensitive subgroups, that appears to be without appreciable risk of noncarcinogenic effects if ingested over a lifetime. Estimated intakes of COPCs are compared with their RfDs to assess the noncarcinogenic hazards Noncancer toxicity values for COPCs for ingestion/dermal and inhalation exposures are presented in **Tables 6-6 and 6-7**, respectively.

6.3.4 Risk Characterization

The risk characterization process estimates the likelihood, incidence and nature of potential effects to human health that may occur as a result of exposure to the groundwater COPCs at the site. The quantitative and qualitative results of the data evaluation, exposure, and toxicity assessment sections were combined to calculate risks for cancer and noncancer health effects. Risks for cancer and noncancer effects were characterized separately because of fundamental differences in the mechanisms through which carcinogens and noncarcinogens act.

6.3.4.1 Carcinogenic Risks

The potential health risks associated with carcinogens were estimated by calculating the increased probability of an individual developing cancer during their lifetime as a result of exposure to a particular chemical at the site. The chemical-specific exposure estimates (i.e., average lifetime dose) were multiplied by the chemical- and route-specific cancer slope factor, averaged over the expected duration of exposure, to arrive at a unitless measure of probability, expressed numerically (e.g., 1×10^{-4} or 1E-4) of an individual developing cancer as a result of chemical exposures at the site.

A cancer risk estimate is a probability that is expressed as a fraction less than 1. For example, a cancer risk of 1×10^{-4} (1E-4) refers to an upper-bound increased chance of one in ten thousand of developing cancer as a result of site-related exposure to a carcinogen over the expected exposure duration. The National Oil and Hazardous Substances Pollution Contingency Plan recommends a target risk goal range for excess cancer risk of 1E-4 to 1E-6.

6.3.4.2 Noncarcinogenic Hazards

The potential for noncarcinogenic effects due to exposure to a particular chemical is expressed as the hazard quotient (HQ). An HQ was calculated by dividing the estimated intake or dose of a chemical by the chemical-specific toxicity value or noncancer RfD Implicit in the HQ is the assumption of a threshold level of exposure below which no adverse effects will occur. If the HQ exceeds 1, site-specific exposure exceeds the RfD and the potential for noncancer adverse effects may exist

6.3.4.3 Results

Tables 6-8 and 6-9, as well as the sections below, summarize the cancer and non-cancer risk characterization results, respectively, for each exposure scenario evaluated for the Northwest Pipe and Casing Superfund Site .

Groundwater Risk and Hazard Results for The Future On-site Maintenance Worker

The risks and hazards to a future maintenance worker on the site were calculated. These risks and hazards were based on combined ingestion, dermal contact and inhalation exposures to groundwater. The incremental RME cancer risk from groundwater exposure is 3.7E-4 and the total incremental CT cancer risk from groundwater exposure is 4.1E-5. Most of the cancer risk is due to ingestion of groundwater contaminated with PCE, TCE, vinyl chloride and arsenic

The noncarcinogenic hazard from groundwater exposure is 0.4 for the RME scenario and 0.2 for the CT scenario. These hazard quotients were virtually entirely due to ingestion of groundwater contaminated with PCE, TCE, vinyl chloride and arsenic

The RME cancer risk of 3.7E-4 exceeds the target risk goal range of 1E-4 to 1E-6. The RME noncarcinogenic hazard of 0.3 is lower than the target HQ of 1.0.

Groundwater Risk and Hazard Results for The Future Off-site Adult Resident

The risks and hazards to a future adult living off-site were calculated. These risks and hazards were based on combined ingestion, dermal contact and inhalation exposures from groundwater used as a source of tap water for indoor use. The total incremental RME cancer risk from groundwater exposure is 1.0E-3 and the total incremental CT cancer risk from groundwater exposure is 9.3E-5. Most of the cancer risk is due to ingestion of PCE and vinyl chloride in groundwater. Additional cancer risks includes those from ingestion of arsenic and TCE in groundwater, and from dermal contact with PCE, TCE and vinyl chloride.

The noncarcinogenic hazard from groundwater exposure is 1.5 for the RME scenario and 0.6 for the CT scenario. These hazard quotients are associated with several metals and several VOCs.

The RME cancer risk of 1 0E-3 significantly exceeds the target risk goal range of 1E-4 to 1E-6. The RME noncarcinogenic hazard of 1.5 is only slightly higher than the target HQ of 1.0

Groundwater Risk and Hazard Results for the Future Off-site Child Resident

The risks and hazards to a future child living off-site were calculated. These risks and hazards were based on combined ingestion, dermal contact and inhalation exposures from groundwater used as a source of tap water for indoor use The total incremental RME cancer risk from groundwater exposure is 5 9E-4 and the total incremental CT cancer risk from groundwater is 6.1E-5. Most of the cancer risk is due to ingestion of PCE and vinyl chloride in groundwater.

The noncarcinogenic hazard from groundwater exposure is 3 for the RME scenario and 1 for the CT scenario. These hazard quotients are associated with several metals and several VOCs.

The RME cancer risk of 5.9E-4 to the off-site child resident exceeds the target risk goal range of 1E-4 to 1E-6. The RME noncarcinogenic hazard of 3 exceeds the target HQ of 1.0.

6.3.5 Risk Assessment Uncertainties

The purpose of a risk assessment is not to predict the actual risk of exposure to an individual. Rather, risk assessments are a management tool for developing conservative estimates of health hazards in order to be protective for the majority of the population and to compensate for uncertainties inherent in estimating exposure and toxicity. As a result, the numerical estimates in a risk assessment (risk values) have associated uncertainties reflecting the limitations in available knowledge about site contaminant concentrations, exposure assumptions (e.g., chronic exposure concentrations, intake rates) and chemical toxicity. This section discusses the most significant sources of uncertainties in the risk assessment for the Northwest Pipe and Casing Company site.

6.3.5.1 Data Collection and Evaluation

Some groundwater samples were collected based on the location of known or suspected areas of contamination. Therefore, these samples may disproportionately represent more contaminated areas of the site. This will tend to overestimate the exposure concentrations of contaminants and therefore exposures and consequently risks may be overestimated.

Contaminants which were not detected in any samples from a given medium were eliminated from consideration in the risk assessment. However, these contaminants may contribute to actual risks if they are present at concentrations in excess of risk-based values. The omission of these contaminants from quantitative analyses may result in an underestimate of risks, but only if these chemicals were actually present Due to the sample quantitation limits associated with these specific analyses, it is not known if these contaminants are actually present at the site in amounts potentially harmful to human health.

6.3.5.2 Exposure

EPA's default exposure duration of 25 years was used for the maintenance worker Since an individual may not hold the same job for 25 years, risks to the maintenance worker may be overestimated.

Since chemical-specific values were not available for all COPCs for dermal absorption factors, gastro-intestinal absorption efficiencies, and dermal permeability constants, surrogate values were used. This may result in under- or overestimation of actual risks

6.3.5.3 Toxicity Assessment and Risk Calculations

The risk and hazard calculations combine uncertainties in the data evaluation, exposure assessment and toxicity assessment sections. Four groundwater COPCs (phenanthrene, 2-methylnaphthalene, acenaphthylene, and lead) lacked both carcinogenic and noncarcinogenic toxicity values for quantitative evaluation Therefore, total cancer and noncancer impacts from COPCs at the site may be underestimated.

6.3.6 Conclusions

Using the most up-to-date methods of risk assessment, which conservatively evaluate the potential for risk, this baseline risk assessment found unacceptable cancer risks to a future on-site maintenance worker from groundwater, primarily through exposure to VOCs via ingestion Also, this risk assessment found unacceptable cancer risks to future off-site adult and child residents from groundwater, primarily through exposure to VOCs via ingestion of and dermal contact with groundwater during all indoor use of tap water.

As explained earlier, there are no current users of groundwater at the site, and therefore there are no current human health risks from groundwater exposure.

6.4 ECOLOGICAL RISK ASSESSMENT

6.4.1 Introduction

An ecological risk assessment was conducted for the Northwest Pipe and Casing Company site. A screening level assessment was conducted initially to clarify the need for a more detailed risk evaluation or the necessity for an interim cleanup action. This screening assessment identified: 1) chemicals in soil, groundwater, surface water and sediment which exceeded toxicity benchmarks or background levels, 2) ecological receptors, including more sensitive species, documented or potentially present in the site vicinity; and 3) potential pathways for exposure to these chemicals. Based on the results of the screening assessment, a detailed baseline risk assessment evaluating ecological exposure to all contaminated media was then conducted.

The ecological risk assessment was described fully in the Soil OU ROD. Since this ROD is for the Groundwater OU, the following discussion of ecological risk focuses only on groundwater exposure.

6.4.2 Ecological Conceptual Site Model

The ecological conceptual site model for the Northwest Pipe and Casing Company site, showing the significant exposure routes, is presented in **Figure 6-2.** The groundwater exposure routes are highlighted in bold. A conceptual site model is a representation of the fate and transport of site-related chemicals relative to specific media (e.g , soil, surface water) and receptors (e.g , fish). Information on receptors and their habitats, chemicals of concern, exposure pathways, and selected assessment and measurement endpoints are integrated into the conceptual model.

As can be seen from **Figure 6-2**, no direct exposure of ecological organisms to groundwater occurs at the site. However, exposure to chemicals in groundwater may occur indirectly because groundwater in the southern portion of the site may discharge seasonally to surface water in the adjacent drainage ditches.

6.4.3 Risk Description

Since there is no direct exposure of ecological organisms to groundwater at the site, there is no associated ecological risk. However, exposure to chemicals in groundwater may occur indirectly because groundwater in the southern portion of Parcel B may discharge seasonally to surface water in the adjacent drainage ditches. Therefore, the ecological risk assessment evaluated exposures for piscivorous (fish-eating) birds, by simulating exposure to surface water with VOC concentrations similar to the concentrations found in the groundwater at the site. The results indicate that adverse effects are not likely to occur to piscivorous birds that feed in the on-site drainage channels or off-site creeks.

EPA also evaluated potential impacts from remedial construction activities at the site to species listed as endangered or threatened under the Endangered Species Act. Dean Creek and Mt. Scott Creek downstream from the site provide habitat for several anadromous fish species listed by National Marine Fisheries Service (NMFS) as threatened. EPA determined that erosion management measures may be necessary during groundwater remedy construction activities at the site to ensure there would be no likely adverse effects on threatened fish species or their essential habitat. Under an informal consultation EPA conducted with the NMFS pursuant to the Endangered Species Act, NMFS concurred with EPA's determination. Therefore, the groundwater remedial alternatives developed by EPA include erosion control measures to protect threatened anadromous fish species.

Table 6-1
Groundwater COPCs and their Exposure Point Concentrations

Chemical of Potential Concern	Frequency of Detection %	Maximum Detected Concentration mg/l	Reasonable Maximum Exposure		Central Tendency	
			Concentration mg/l	Statistical Measure	Concentration mg/l	Statistical Measure
Acenaphthene	10	3 00E-01	4 40E-02	95% UCL	1 94E-02	Mean
Acenaphthylene	5	1 00E-03	1 00E-03	MAX	1 00E-03	MAX
Acetone	4	9 20E-01	1 06E-01	95% UCL	4 03E-02	Mean
Arsenic	35	5 00E-03	2 52E-03	95% UCL	2 18E-03	Mean
Benzene	17	1 00E-03	6 03E-04	95% UCL	5 39E-04	Mean
bis(2-Ethylhexyl)phthalate	38	9 00E-03	3 89E-03	95% UCL	3 12E-03	Mean
Cadmium	13	2 00E-03	8 63E-04	95% UCL	6 98E-04	Mean
Carbon Tetrachloride	4	2 50E-02	3 33E-03	95% UCL	1 58E-03	Mean
Chloroform	21	1 10E-02	1 84E-03	95% UCL	1 10E-03	Mean
Dibenzofuran	10	6 90E-02	1 26E-02	95% UCL	6 83E-03	Mean
1,1-Dichloroethene	17	3 00E-03	9 68E-04	95% UCL	7 63E-04	Mean
Cis-1,2-Dichloroethene	54	8 50E-01	1 40E-01	95% UCL	7 49E-02	Mean
Fluorene	5	7 70E-02	1 22E-02	95% UCL	6 05E-03	Mean
Iron	52	3 31E+00	1 17E+00	95% UCL	8 13E-01	Mean
Lead	22	1 80E-01	2 81E-02	95% UCL	1 50E-02	Mean
Manganese	100	2 52E+00	9 19E-01	95% UCL	6 47E-01	Mean
Mercury	4	2 00E-03	3 05E-04	95% UCL	1 61E-04	Mean
2-Methylnaphthalene	10	2 00E-03	2 00E-03	MAX	2 00E-03	MAX
Phenanthrene	10	1 80E-02	4 70E-03	95% UCL	3 40E-03	Mean
Pyrene	14	2 10E-02	4 90E-03	95% UCL	3 38E-03	Mean
Tetrachloroethene	50	11 00E+00	1 28E+00	95% UCL	4 92E-01	Mean
Thallium	4	1 00E-03	1 00E-03	MAX	1 00E-03	MAX
1,1,2-Trichloroethane	4	4 00E-03	9 61E-04	95% UCL	7 08E-04	Mean
Trichloroethene	54	3 20E-01	5 34E-02	95% UCL	2 89E-02	Mean
Vinyl Chloride	50	1 00E-01	1 60E-02	95% UCL	8 48E-03	Mean

Notes mg/l - milligrams per liter
95% UCL - 95% Upper Confidence Limit

Table 6-2
Exposure Factors for Future On-site Maintenance Worker

Exposure Factors	Groundwater	
	RME	CT
Body weight (kg)	70	70
Ingestion rate (L/day)	1 0	0 7
Skin surface area (cm^2)	2,500	2,500
Exposure time (hrs/day)	0 25	0 17
Exposure frequency (days/year)	250	250
Exposure duration (years)	25	9

Table 6-3
Exposure Factors for Future Adult and Child Off-site Residents

Exposure Factors	Groundwater			
	Adult		Child	
	RME	CT	RME	CT
Body weight (kg)	70	70	15	15
Ingestion rate (L/day)	2 0	1 4	1 0	0 7
Skin surface area (cm^2)	22,000	18,000	7,500	6,000
Exposure frequency (days/year)	350	350	350	350
Exposure duration (years)	24	7	6	2
Exposure time (hrs/day) - dermal	0 25	0 17	0 25	0 17
Inhalation rate (m^3/day)	15	15	18	18
Volatilization factor	0 0005	0 0005	0 0005	0 0005

Table 6-4
Cancer Toxicity Data, Oral/Dermal

Chemical of Potential Concern	Oral Cancer Slope Factor (3)	Oral to Dermal Adjustment Factor (4,5)	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence Cancer Guideline Description	Source	Date (2)
Acenaphthene	NA	0 31	NA	NA	NA	NA	NA
Acenaphthylene	NA	0 31	NA	NA	D	IRIS	02/23/98
Acetone	NA	0 83	NA	NA	D	IRIS	02/23/98
Arsenic	1 5E+0	0 41	3 7E+0	1/(mg/kg-day)	A	IRIS	02/23/98
Benzene	2 9E-2	0 97	3 0E-2	1/(mg/kg-day)	A	IRIS	02/24/98
bis(2-ethylhexyl)phthalate	1 4E-2	0 19	7 4E-2	1/(mg/kg-day)	B-2	IRIS	05/01/98
Cadmium	NA	0 01	NA	NA	B-1	IRIS	02/24/98
Carbon Tetrachlonde	1 3E-1	0 65	2 0E-1	1/(mg/kg-day)	B-2	IRIS	35850
Chloroform	6 1E-3	0 2	3 1E-2	1/(mg/kg-day)	B-2	IRIS	02/24/98
Dibenzofuran	NA	0 5	NA	NA	D	IRIS	02/24/98
1,1-Dichloroethene	6E-1	1	6 0E-1	1/(mg/kg-day)	C	IRIS	02/24/98
cıs-1,2-Dichloroethene	NA	0 8	NA	NA	D	IRIS	02/24/98
Fluorene	NA	0 31	NA	NA	D	IRIS	02/24/98
Iron	NA	0 15	NA	NA	NA	NA	NA
Lead	NA	0 15	NA	NA	B-2	IRIS	02/24/98
Manganese	NA	0 04	NA	NA	D	IRIS	02/24/98
Mercury	NA	0 0001	NA	NA	D	IRIS	02/24/98
2-Methylnaphthalene	NA	0 80	NA	NA	NA	NA	NA
Phenanthrene	NA	0 73	NA	NA	D	IRIS	02/24/98
Pyrene	NA	0 31	NA	NA	D	IRIS	02/24/98
Tetrachloroethene	5 2E-2	1 00	5 2E-2	1/(mg/kg-day)	C-B2	NCEA	___
Thallium	NA	0 15	NA	NA	D	IRIS	02/24/98
1,1,2-Tnchloroethane	5 7E-2	0 81	7 0E-2	1/(mg/kg-day)	C	IRIS	02/24/98
Trichloroethene	1 1E-2	0 15	7 3E-2	1/(mg/kg-day)	C-B2	NCEA	___
Vinyl Chlonde	1 9	1 00	1 9E+0	1/(mg/kg-day)	A	HEAST	07/01/97

Notes for Table 6-4 are included on the following page

IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997

Weight of Evidence
Known/likely
Cannot be Determined
Not Likely

EPA Group
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

(1) Adjusted dermal slope factors calculated by dividing unadjusted CSF by the adjustment factor
(2) For IRIS values, provide the date IRIS was searched For HEAST values, provide the date of HEAST
(3) Slope factors for carcinogenic PAHs (including benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h anthracene, and indeno(1,2,3-cd)pyrene, were calculated using an equivalency factor approach based on Benzo(a)pyrene (based on EPA 1993a)
(4) Values from Interim Final Guidance Developing Risk-Based Cleanup Levels at Resource Conservation and Recovery Act Sites in Region 10 EPA/910/R-98/001
(5) In absence of chemical-specific oral to dermal adjustment factors listed in Appendix L (EPA 1998c), default values from Section 4 6 3 6 (EPA 1998c) were used for dibenzofuran and cis- and trans- 1,2-dichloroethene, the value for fluoranthene was used for fluorene
(6) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b), EPA's National Center for Environmental Assessment (EPA, 1998d), and EPA Region IX's PRG Tables (EPA 1998e)

Table 6-5
Cancer Toxicity Data, Inhalation

Chemical of Potential Concern	Unit Risk	Units	Adjustment (1)	Inhalation Cancer Slope Factor	Units	Weight of Evidence Cancer Guideline Description	Source (3)	Date (2)
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	D	IRIS	02/23/98
Acetone	NA	NA	NA	NA	NA	D	IRIS	02/23/98
Arsenic	4 5E-3	$(\mu g/m^3)^{-1}$	3500	1 6E+1	1/(mg/kg-day)	A	IRIS	02/23/98
Benzene	8 3E-6	$(\mu g/m^3)^{-1}$	3500	2 9E-2	1/(mg/kg-day)	A	IRIS	02/24/98
bis(2-ethylhexyl)phthlate	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	1 8E-3	$(\mu g/m^3)^{-1}$	3500	6 3E+0	1/(mg/kg-day)	B-1	IRIS	02/24/98
Carbon Tetrachloride	1 5E-5	$(\mu g/m^3)^{-1}$	3500	5 3E-2	1/(mg/kg-day)	B-2	IRIS	02/24/98
Chloroform	2 3E-5	$(\mu g/m^3)^{-1}$	3500	8 1E-2	1/(mg/kg-day)	B-2	IRIS	02/24/98
Dibenzofuran	NA	NA	NA	NA	NA	D	IRIS	02/24/98
1,1-Dichloroethene	5 0E-5	$(\mu g/m^3)^{-1}$	3500	1 8E-1	1/(mg/kg-day)	C	IRIS	02/24/98
cis-1,2-Dichloroethene	NA	$(\mu g/m^3)^{-1}$	NA	NA	NA	D	IRIS	02/24/98
Fluorene	NA	NA	NA	NA	NA	D	IRIS	02/24/98
Iron	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	B-2	IRIS	02/24/98
Manganese	NA	NA	NA	NA	NA	D	IRIS	02/24/98
Mercury	NA	NA	NA	NA	NA	D	IRIS	02/24/98
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	D	IRIS	02/24/98
Pyrene	NA	NA	NA	NA	NA	D	IRIS	02/24/98
Tetrachloroethene	2 9E-7 - 9 5E-7	$(\mu g/m^3)^{-1}$	3500	2 0E-3	1/(mg/kg-day)	C - B-2	NCEA	05/15/98
Thallium	NA	NA	NA	NA	NA	D	IRIS	02/24/98
1,1,2-Trichloroethane	1 6E-5	$(\mu g/m^3)^{-1}$	3500	5 6E-2	1/(mg/kg-day)	C	IRIS	02/24/98
Trichloroethene	0 0000017	$(\mu g/m^3)^{-1}$	3500	6 0E-3	1/(mg/kg-day)	C - B-2	NCEA	05/15/98
Vinyl Chloride	8 4E-5	$(\mu g/m^3)^{-1}$	3500	2 9E-1	1/(mg/kg-day)	C	IRIS HEAST	02/24/98 07/97

Notes for Table 6-5 are included on the following page

IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997

EPA Group
A - Human carcinogen
B1 - Probable human carcinogen - indicates that limited human data are available
B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans
C - Possible human carcinogen
D - Not classifiable as a human carcinogen
E - Evidence of noncarcinogenicity

<u>Weight of Evidence</u>
Known/likely
Cannot be Determined
Not Likely

(1) CSFs were derived from unit risks based on a 70 kg body weight and a daily personal inhalation rate of 20 m3/day, per RAGS (EPA 1989a)
(2) For IRIS values, provide the date IRIS was searched
For HEAST values, provide the date of HEAST
(3) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b)
Additional values were obtained from EPA's National Center for Environmental Assessment (EPA, 1998d)

Table 6-6
Noncancer Toxicity Data, Oral/Dermal

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value (4)	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (3)
Acenaphthene	Chronic	6 0E-2	mg/kg-day	0 31	1 9E-2	mg/kg-day	liver	3000	IRIS HEAST	02/23/98 07/97
Acenaphthylene	NA	NA	NA	0 31	NA	NA	NA	NA	NA	NA
Acetone	Chronic	1 0E-1	mg/kg-day	0 83	8 3E-2	mg/kg-day	liver, kidney	1000	IRIS	02/23/98
Arsenic	Chronic	3 0E-4	mg/kg-day	0 41	1 2E-4	mg/kg-day	skin	3	IRIS	02/23/98
Benzene	NA	3 0E-3	mg/kg-day	0 97	2 9E-3	mg/kg-day	NA	NA	NCEA (per R9)	05/01/98
bis(2-ethylhexyl)phthalate	Chronic	2 0E-2	mg/kg-day	0 19	3 8E-3	mg/kg-day	liver, reproductive	1000	IRIS	05/01/98
Cadmium	Chronic/ water	5 0E-4	mg/kg-day	0 01	5 0E-6	mg/kg-day	NOEL	10	IRIS	02/24/98
Cadmium	Chronic/ food	1E-3	mg/kg-day	0 01	1 0E-5	mg/kg-day	NOEL	10	IRIS	02/24/98
Carbon tetrachloride	Chronic	7 0E-4	mg/kg-day	0 65	4 6E-4	mg/kg-day	liver	1000	IRIS	02/24/98
Chloroform	Chronic	1 0E-2	mg/kg-day	0 20	2 0E-3	mg/kg-day	liver	1000	IRIS	02/24/98
Dibenzofuran	NA	4 0E-3	mg/kg-day	0 5	2 0E-3	mg/kg-day	NA	NA	R9	05/01/98
1,1-Dichloroethene	Chronic	9E-3	mg/kg-day	1 00	9 0E-3	mg/kg-day	liver	1000	IRIS	02/24/98
cis-1,2-Dichloroethene	Chronic	1E-2	mg/kg-day	0 8	8 0E-3	mg/kg-day	blood	3000	HEAST	07/97
Fluorene	Chronic	4E-2	mg/kg-day	0 31	1 2E-2	mg/kg-day	blood	3000	IRIS	02/24/98
Iron	Chronic	3 0E-1	mg/kg-day	0 15	4 5E-2	mg/kg-day	liver, blood, g/i	1	NCEA	05/15/98
Lead	NA	NA	NA	0 15	NA	NA	NA	NA	NA	NA
Manganese	Chronic	1 4E-1	mg/kg-day	0 040	5 6E-3	mg/kg-day	CNS	1	IRIS	02/24/98
Mercury	NA	NA	NA	0 00	NA	NA	NA	NA	NA	NA
2-Methylnaphthalene	NA	NA	NA	0 80	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	0 73	NA	NA	NA	NA	NA	NA
Pyrene	Chronic	3E-2	mg/kg-day	0 31	9 3E-3	mg/kg-day	kidney	3000	IRIS	02/24/98
Tetrachloroethene	Chronic	1E-2	mg/kg-day	1 00	1 0E-2	mg/kg-day	liver	1000	IRIS HEAST	02/24/98 07/97
Thallium	Subchronic	8E-5	mg/kg-day	0 15	1 2E-5	mg/kg-day	NOEL	3000	IRIS	02/24/98
1,1,2-Trichloroethane	Chronic	4E-3	mg/kg-day	0 81	3 2E-3	mg/kg-day	blood	1000	IRIS	02/24/98
Trichloroethene	NA	6 0E-3	mg/kg-day	0 15	9 0E-4	mg/kg-day	NA	NA	R9	35916
Vinyl Chloride	NA	NA	NA	1 00	NA	NA	NA	NA	NA	NA

Notes for Table 6-6 are included on the following page

IRIS = Integrated Risk Information System
HEAST= Health Effects Assessment Summary Tables
NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997b)

(1) Values from Interim Final Guidance Developing Risk-Based Cleanup Levels At RCRA Sites in Region 10 EPA/910/R-98/001
(2) Adjusted the dermal reference doses by multiplying unadjusted RfD by the adjustment factor
(3) For IRIS values, provide the date IRIS was searched
For HEAST values, provide the date of HEAST
(4) The RfD for Aroclor 1254 was used as a surrogate for Aroclors 1248 and 1260
(5) In absence of chemical-specific oral to dermal adjustment factors listed in Appendix L (EPA 1998c), default values from Section 4 6 3 6 (EPA 1998c) were used for dibenzofuran and cis- and trans- 1,2-dichloroethene, the value for fluoranthene was used for fluorene
6) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b), EPA's National Center for Environmental Assessment (EPA, 1998d), and EPA Region IX's PRG Tables (EPA 1998e)

Table 6-7
Noncancer Toxicity Data, Inhalation

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC Value	Inhalation RfC Units	Adjusted Inhalation RfD (1)	Adjusted Inhalation Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2)
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	NA	NA	NA	1 7E-3	mg/kg-day	NA	NA	NCEA (per R9)	5/1/98
bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon Tetrachloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	Chronic	5 0E-5	mg/m^3	1 4E-5	mg/kg-day	nervous system	1000/1	IRIS	02/24/98
Mercury	Chronic	3 0E-4	mg/m^3	8 6E-5	mg/kg-day	nervous system	30	IRIS	02/24/98
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	Chronic	4 0E-1	mg/m^3	1 1E-1	mg/kg-day	liver, kidney, brain	30	NCEA	5/15/98
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl Chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes for Table 6-7 are included on the following page

NA = Not available in IRIS (EPA 1998a) or HEAST (EPA 1997b)
(1) RfDs were derived from RfCs based on a 70 kg body weight and a daily personal inhalation rate of 20 m^3/day, per RAGS (EPA 1989a)
(2) For IRIS values, provide the date IRIS was searched
For HEAST values, provide the date of HEAST
(3) Values were obtained, in order of preference, from EPA's Integrated Risk Information System (EPA 1998a), EPA's Health Effects Assessment Summary Tables (EPA 1997b)
Additional values were obtained from EPA's National Center for Environmental Assessment (EPA, 1998d) and EPA Region IX's PRG Tables (EPA 1998e)

Table 6-8
Summary of Carcinogenic Human Health Risks from Groundwater

Exposure Pathway	On-site Maintenance Worker		Adult Off-site Resident		Child Off-site Resident	
	RME	CT	RME	CT	RME	CT
Ingestion	3.5E-4	4.0E-5	9.5E-4	8.7E-5	5.5E-4	5.8E-5
Dermal Contact	1.3E-5	9.5E-7	9.1E-5	5.9E-6	3.6E-5	2.6E-6
Inhalation-Vapor			1.9E-9	4.4E-10	2 6E-9	7.0E-10
Groundwater-total	**3.7E-4**	**4.1E-5**	**1.0E-3**	**9.3E-5**	**5.9E-4**	**6.1E-5**

Table 6-9
Summary of Noncarcinogenic Human Health Hazards from Groundwater

Exposure Pathway	On-site Maintenance Worker		Adult Off-site Resident		Child Off-site Resident	
	RME	CT	RME	CT	RME	CT
Ingestion	3E-1	1E-1	9E-1	4E-1	2E+0	1E+0
Dermal Contact	8E-2	2E-2	6E-1	1E-1	9E-1	2E-1
Inhalation-Vapor			7E-3	5E-3	4E-2	3E-2
Groundwater - total	**4E-1**	**1E-1**	**1.5E+0**	**5E-1**	**3E+0**	**1E+0**

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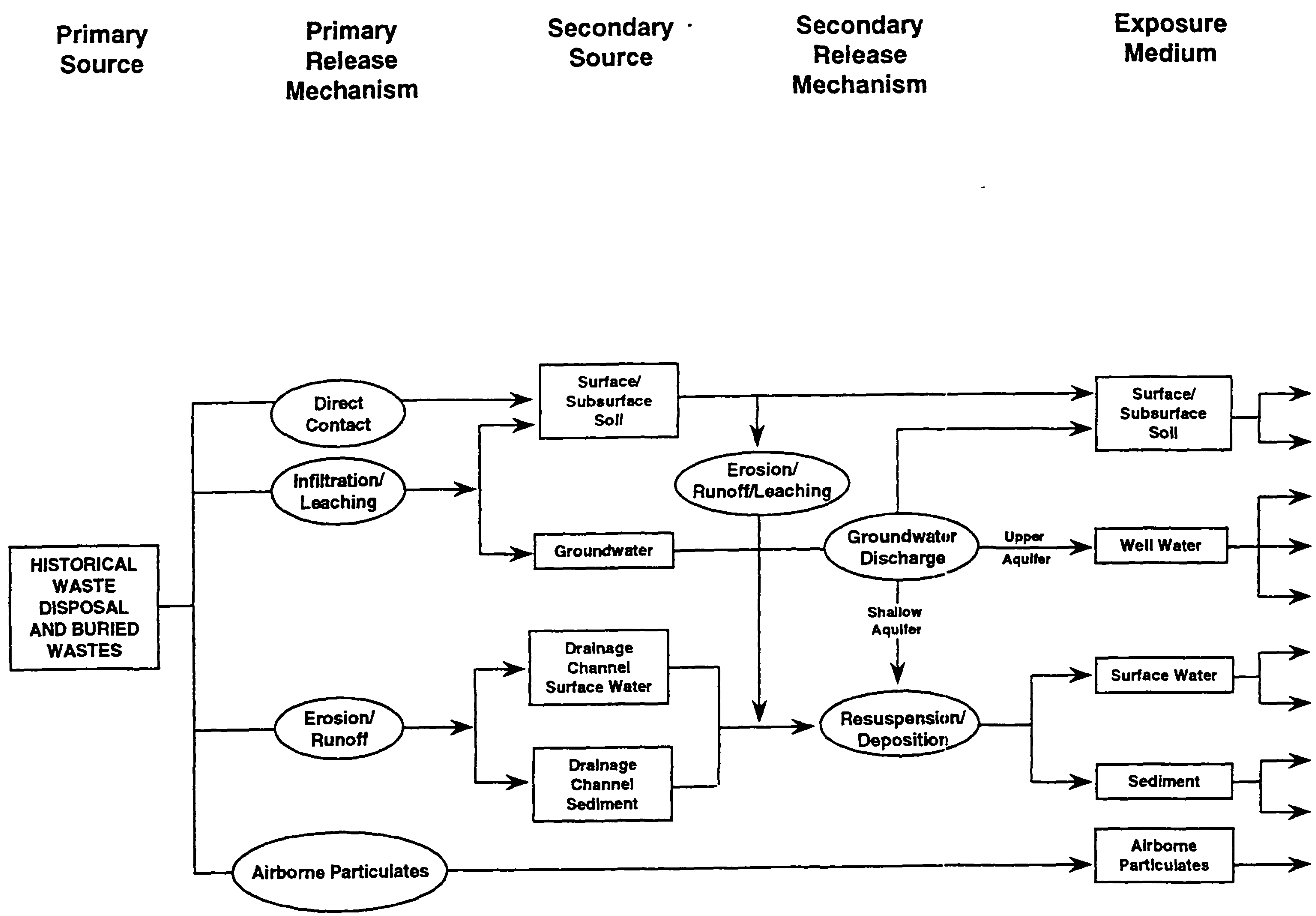

Exposure Pathway	Current Off-Site Residents (Trespassers)	Future Off-Site Residents	Future On-Site Construction Worker	Future On-Site Maintenance Worker
Ingestion - Soils	●	–	●	●
Dermal Contact - Soils	●	–	●	●
Ingestion - Upper Aquifer Well Water	–	●	–	●
Dermal Contact - Upper Aquifer Well Water	–	●	–	●
Inhalation - Upper Aquifer Well Water	–	●	–	○
Ingestion - Surface Water	●	–	–	–
Dermal Contact - Surface Water	●	–	–	–
Ingestion - Sediment	●	–	–	–
Dermal Contact - Sediment	●	–	–	–
Inhalation—Soils	○	–	●	●

Receptor *

EXPLANATION

● Represents a primary exposure pathway to be quantitatively evaluated in the risk assessment.

– Represents an incomplete exposure pathway for this receptor

○ Pathway considered to be a negligible source of exposure for this receptor. Pathway not quantitatively evaluated in the risk assessment

* Primary exposure pathways represent exposures that may contribute significantly to risk. On-site residential land use has not occurred in the past and is not expected now or in the future.

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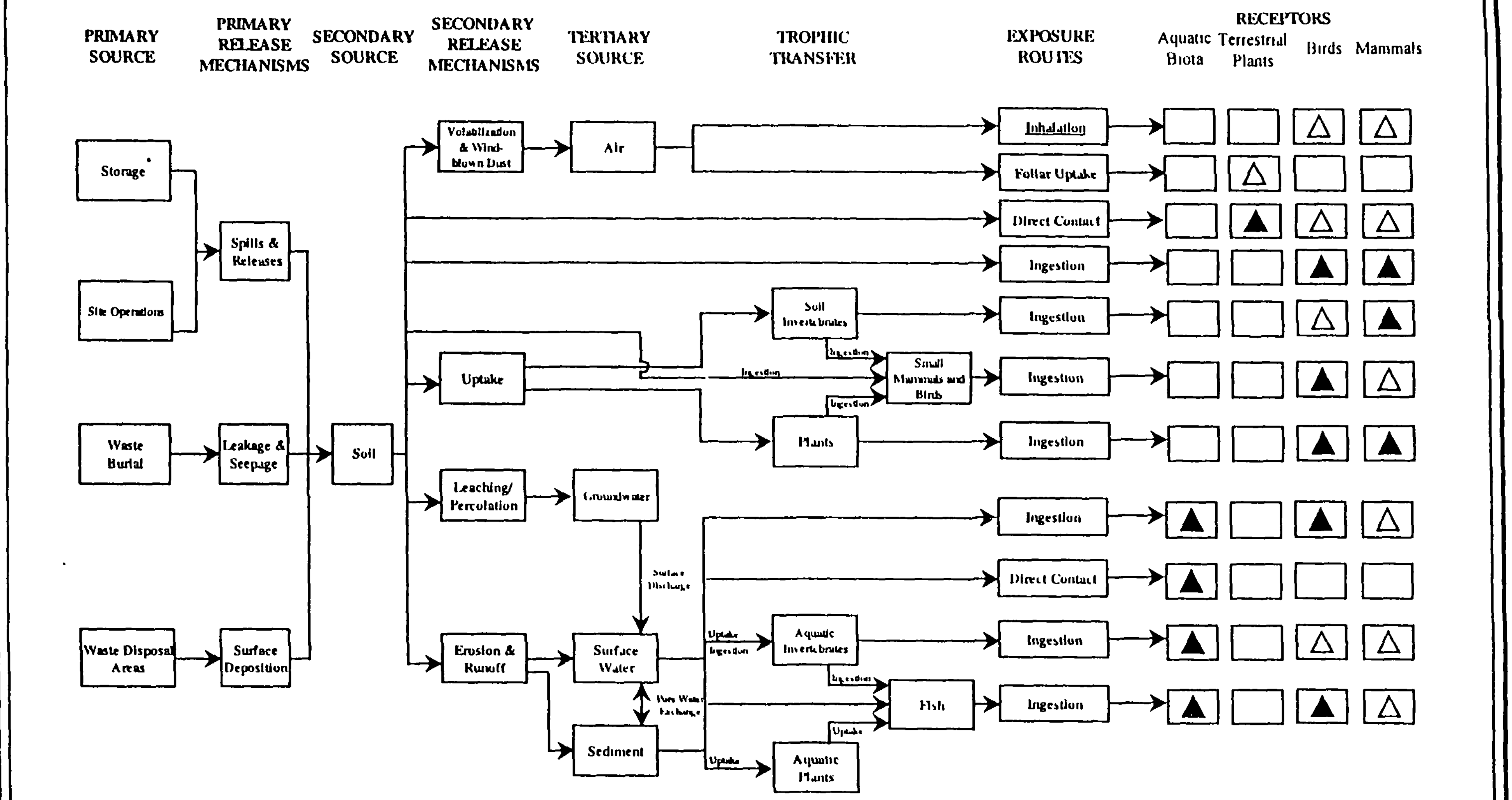
Northwest Pipe & Casing Ecological BRA: Conceptual Human Health Exposure Model

Figure 6-1

14 July 1998



Ecological Site Conceptual Model

▲ Significant exposure route for this receptor

△ Exposure route determined to be less significant, or cannot be evaluated for this receptor

Exposure route not applicable for this receptor

WESTON. MANAGERS DESIGNERS/CONSULTANTS

Figure
6-2

98-0202a ppt

7.0 REMEDIAL ACTION OBJECTIVES

7.1 NEED FOR REMEDIAL ACTION

The results of the baseline human health risk assessment indicate that potential risks from groundwater exposure to future maintenance workers at the site and to future off-site residents are above the acceptable risk levels set under both federal Superfund and Oregon Environmental Cleanup Law regulations. The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. Such a release or threat of release may present an imminent and substantial endangerment to public health, welfare, or the environment. Consistent with NCP and EPA policy, remedial action is warranted to address these potential risks.

Remedial action objectives (RAOs) consist of medium-specific or location-specific goals for protecting human health and the environment. Groundwater contaminants of concern (COCs) were selected from the COPCs evaluated in the baseline risk assessment, based on potential human exposures at the site, and include three specific chlorinated VOCs. RAOs were developed for the Northwest Pipe and Casing Company site for these COCs.

7.2 RAOs

The following RAOs for groundwater have been developed for the Northwest Pipe and Casing Company site·

- Prevent exposure of future off-site residents and future on-site maintenance workers from direct contact (ingestion, dermal contact and inhalation) to contaminated upper aquifer groundwater that would result in an excess lifetime cancer risk greater than one in 1,000,000 for individual carcinogens, above 1 in 100,000 for additive carcinogenic contaminants, or above a Hazard Index of 1.

- Prevent migration of upper aquifer groundwater with contaminant concentrations that would result in an excess lifetime cancer risk greater than one in 1,000,000 for individual carcinogens, above 1 in 100,000 for additive carcinogenic contaminants, or above a Hazard Index of 1 to off-site areas or deeper aquifers.

- Restore use of the upper aquifer groundwater as a drinking water source. The goals for restoration are the federal and state safe drinking water standards (MCLs), which are 5 $\mu g/L$ for PCE, 5 $\mu g/L$ for TCE and 2 $\mu g/L$ for vinyl chloride

The rationale for each of the RAOs and the establishment of remediation goals is described in the following subsections. The RAOs and cleanup (remediation) goals are summarized in **Table 7-1.**

No RAO or remediation goal has been developed for protection of ecological receptors because: 1) there is no direct exposure of ecological organisms to groundwater, and 2) the baseline risk assessment determined that there were no significant risks to piscivorous birds from exposure to groundwater migrating to surface water bodies.

7.2.1 Exposure to Carcinogenic VOCs in Upper Aquifer Groundwater

The first RAO for protection of human health is preventing the ingestion and inhalation of, and dermal contact with, upper aquifer groundwater containing VOCs above health-based levels, for future off-site residents and future on-site maintenance workers.

Parcel B is zoned by Clackamas County for commercial and light industrial use. EPA believes redevelopment of Parcel B is likely to occur in the foreseeable future, based on the development interest expressed by several private and public parties and because it is a significant size (32 acres) of available land, has railroad access, and is situated in close proximity to existing industrial and commercial businesses and parcels of property recently undergoing development. Parcel B may have roadways constructed on it in the future, according to Clackamas County and the Oregon Department of Transportation Future maintenance workers on Parcel B under the reasonably anticipated future land use could be exposed to groundwater contaminants.

Land use in the vicinity of the site also includes a residential area Hollywood Garden to the south and some isolated residences to the west of the site, which are served by a local water utility. Groundwater at the site flows in a northerly direction and therefore is not expected to flow towards any currently residential areas. Area to the north of site includes undeveloped industrial/commercial- zoned property It is possible, though unlikely, that this property could be re-zoned in the future to allow residential use. Since there are no prohibitions on using the local groundwater for domestic purposes, future off-site residents could be exposed to groundwater contaminants migrating from the Northwest Pipe and Casing Company site. The groundwater is considered to be a *potential* source of drinking water and therefore is classified as Class II groundwater under "EPA Guidelines for Ground-Water Classification" Final Draft, December 1986.

Carcinogenic VOCs are the primary human health risk drivers in groundwater, based on the baseline risk assessment The remediation goals for PCE, TCE and vinyl chloride are ARAR-driven, based on the Oregon Environmental Cleanup Rules maximum acceptable risk levels. Under the NCP, EPA typically uses Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act regulations as a default point for setting remediation goals for groundwater which could be used for drinking water. MCLs are 5 μg/l for PCE, 5 μg/l for TCE and 2 μg/l for vinyl chloride. However, Oregon Environmental Cleanup Rules require a maximum acceptable excess cancer risk level of 1 X 10^{-6} for individual carcinogens for groundwater which is used for drinking water. This results in target groundwater cleanup concentrations of 0.9 μg/l PCE, 1 6 μg/l

TCE and 0.02 μg/l for vinyl chloride. The target groundwater cleanup concentrations for PCE and vinyl chloride are lower than their respective detection limits of 1.0 μg/l using standard analytical methods. In such instances, DEQ guidance provides for adjusting the target groundwater cleanup level to the detection limit of the contaminant. Accordingly, the final groundwater remediation goals are as follows:

- 1.0 μg/l for PCE,
- 1.6 μg/l for TCE
- 1.0 μg/l for vinyl chloride

The remediation goals for VOCs are applicable to all upper aquifer groundwater on the site.

7.2.2 Migration of VOC-Contaminated Groundwater

The second RAO for protection of human health is preventing migration of upper aquifer groundwater which exceeds health-based levels for carcinogenic VOCs to either off-site areas or to deeper aquifers. Site investigations found four (4) plumes of VOC-contaminated groundwater on the site. These plumes likely originated from on-site sources of VOCs in the soil or from direct releases to the groundwater. PCE, TCE and vinyl chloride were shown in the baseline risk assessment to be the primary human health risk drivers in groundwater, using the exposure scenario of a future off-site resident using groundwater for indoor purposes and a future maintenance worker ingesting or having dermal contact with groundwater. Groundwater at and in the site vicinity has the potential to be used for drinking water in the future. Modeling has shown that site groundwater could move off-site in a northerly downgradient direction if no actions are taken. Therefore, the objective of this RAO is to prevent the spread of upper aquifer groundwater contaminants to either off-site areas or to deeper aquifers.

The remediation goals for PCE, TCE and vinyl chloride identified above for on-site groundwater will also be protective of this RAO, by ensuring that groundwater which may migrate off-site or to deeper aquifers will not exceed maximum acceptable risk levels established under Oregon Environmental Cleanup Rules.

7.2.3 Soil-to-Groundwater Transfer of Chlorinated VOCs

In the Soil OU ROD (June 2000) EPA established soil remediation goals for PCE, TCE and vinyl chloride to reduce the potential for VOCs sorbed onto soil particles to partition into the groundwater. As described in the Soil OU ROD, a simple linear equilibrium soil/water partition equation was used to convert the target groundwater concentrations to respective soil concentrations constituting the RGs The soil remediation goals for PCE, TCE and vinyl chloride are applicable to on-site surface and subsurface soil located above the water table, which varies from approximately 4 to 10 feet bgs. These soil remediation goals are complementary to the groundwater remediation goals identified above and therefore are referenced by this ROD.

7.2.4 Restoration of Upper Aquifer as Source of Drinking Water

This RAO is to restore the potential use of the upper aquifer on the site as a future source of drinking water. The NCP establishes an expectation that Superfund response actions " ..will return useable ground waters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site." The upper aquifer has the potential to be used as a source of drinking water in the future and therefore its restoration to such use is an RAO for the groundwater remedy at the site. Because the on-site upper aquifer is not expected to be needed as a source of drinking water in the near term, EPA considers an extended restoration timeframe (50 years or more) is reasonable.

The remediation goals for restoration of the upper aquifer as a source of drinking water are the Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act regulations. MCLs are 5 μg/l for PCE, 5 μg/l for TCE and 2 μg/l for vinyl chloride

7.3 SUMMARY OF MAIN ARARS DRIVING THE REMEDY

The principal ARARs driving selection of the groundwater remedial action at the site include the following:

- Oregon Environmental Cleanup Rules, OAR 340-122
- Safe Drinking Water Act Regulations, 40 CFR Part 141, Maximum Contaminant Levels

These and other ARARs are discussed in more depth in Section 11.2

7.4 DISTRIBUTION AND QUANTITY OF GROUNDWATER CONTAMINANTS EXCEEDING REMEDIATION GOALS

Chlorinated VOCs were detected extensively across Parcel B and the western portion of Parcel A. The approximate lateral extent of the upper aquifer groundwater which exceeds the remediation goal for PCE is shown in **Figure 5-12.** Four groundwater plumes of PCE and its breakdown products in the shallow upper aquifer were identified through the various groundwater investigations.

Plume 1, originating near former Plant 3, is the largest plume at an estimated 12 acres and includes the highest PCE concentrations on the site. This plume extends north-northwest to the southern portion of Parcel A. Groundwater PCE concentrations in the source area of this plume were as high as 11,000 μg/l and exceedances of the cleanup goals were detected to depths of up to 52 feet bgs.

Plume 2 is located in the southwestern portion of Parcel B and is approximately 9 acres in size and extends to a depth of 40 feet bgs. This plume has no identifiable discrete source area. Groundwater PCE concentrations in this plume were as high as 100 μg/l and exceedances of the cleanup goals were detected to depths of up to 50 feet bgs.

Plume 3 is located in the southeast corner of Parcel B and is approximately 3.5 acres in size. This plume has high VOC concentrations at depth (5,860 μg/l was detected at 50 feet bgs). and extends to a depth of 60 feet bgs.

Plume 4 is located on Parcel A in the northern portion of the site and is migrating toward the northern off-site area. The groundwater plume appears to be comingled with Plume 1; the comingled plume is an estimated 20 acres in size, extending to a depth of 55 feet bgs, with PCE concentrations as high as 180 μg/l.

All of the contaminated groundwater plumes extend in a north-south direction, which is the direction of groundwater flow at the site.

The concentrations of chlorinated solvents generally decrease with increasing depth in the upper aquifer, although groundwater concentrations exceeding the remediation goals were detected at depths up to 50 feet bgs. The shallow portion (0 to 20 feet bgs) of the upper aquifer is most impacted by the chlorinated solvents. None of the plumes of contaminated groundwater have moved off the site to date.

At monitoring wells located at the suspected source areas of the Parcel B groundwater plumes (MW-01, MW-02 and MW-04), the concentrations of PCE and TCE have been declining over time **(Figures 5-9 through 5-11)**.

7.5 PRINCIPAL THREATS

The National Contingency Plan establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practical. Generally, principal threat wastes are source materials considered to be highly toxic or highly mobile which generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

In the Soil OU ROD for the site, EPA identified principal threat wastes as follows: soil with individual carcinogenic HPAH concentrations 100 or more times greater than the respective RGs, soil with PCB concentrations greater than 160 mg/kg; and soil with concentrations greater than 39 μg/L of PCE, 40 μg/L of TCE, or 9 μg/L of vinyl chloride.

The soil principal threat wastes at the site are being removed and either treated or disposed off-site under the Soil OU Remedial Action being conducted in 2001.

Contaminated groundwater plumes are generally not considered to be source material and therefore are not principal threat wastes. Nonetheless, the groundwater remedy selected in this ROD provides for treating VOC-contaminated groundwater at the site to the maximum extent practicable

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Table 7-1
Summary of Groundwater RAOs and Remediation Goals

RAOs	COC	RG	Basis of RG
Prevent exposure of future on-site maintenance workers and future off-site residents from direct contact (ingestion, inhalation and dermal contact) to contaminated upper aquifer groundwater that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Index of 1. Prevent migration of upper aquifer groundwater with contaminant concentrations that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Index of 1 to off-site areas or deeper aquifers. Restore use of the upper aquifer groundwater as a drinking water source. The goals for restoration are the federal and state safe drinking standards (MCLs) for PCE, TCE and vinyl chloride	Tetrachloroethene (PCE) Trichloroethene (TCE) Vinyl chloride	1 0 μg/l 1.6 μg/l 1.0 μg/l	Oregon Environmental Cleanup Rules: groundwater useable for drinking water, risk-based cleanup option, 1 X 10^{-6} excess carcinogenic risk, adjusted for standard analytical methods detection limits.

Notes
COC - chemical of concern
μg/l - micrograms per liter or parts per billion
RAO - remedial action objective
RG - remediation goal

Table 7-1
Summary of Groundwater RAOs and Remediation Goals

RAOs	COC	RG	Basis of RG
Prevent exposure of future on-site maintenance workers and future off-site residents from direct contact (ingestion, inhalation and dermal contact) to contaminated upper aquifer groundwater that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Index of 1. Prevent migration of upper aquifer groundwater with contaminant concentrations that would result in an excess lifetime cancer risk greater than one in a million (1E-06) for individual carcinogens, above 1E-05 for additive carcinogenic contaminants, or above a Hazard Index of 1 to off-site areas or deeper aquifers. Restore use of the upper aquifer groundwater as a drinking water source. The goals for restoration are the federal and state safe drinking standards (MCLs) for PCE, TCE and vinyl chloride	Tetrachloroethene (PCE) Trichloroethene (TCE) Vinyl chloride	1.0 μg/l 1 6 μg/l 1.0 μg/l	Oregon Environmental Cleanup Rules: groundwater useable for drinking water, risk-based cleanup option, 1 X 10^{-6} excess carcinogenic risk, adjusted for standard analytical methods detection limits

Notes
COC - chemical of concern
μg/l - micrograms per liter or parts per billion
RAO - remedial action objective
RG - remediation goal

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8.0 DESCRIPTION OF GROUNDWATER ALTERNATIVES

8.1 Technology Screening and Development of Alternatives

It is EPA's intent to reduce the risk to humans from contaminated groundwater to acceptable levels by meeting the RAOs specified in Section 7.2 through the design and implementation of remedial actions.

Groundwater modeling for the site predicts that groundwater VOC concentrations would exceed the remediation goals on-site for greater than 200 years if nothing was done. Also, the modeling predicts that groundwater exceeding the remediation goals may move to off-site areas; the maximum distance of off-site exceedance of the PCE remediation goal is predicted to be 100 feet north of Lawnfield Road.

Since upper aquifer groundwater at the site is not currently used for domestic purposes, and there is no near-term future need to use the groundwater for domestic purposes, EPA believes it is appropriate to consider an extended period of time to achieve remediation goals. Accordingly, some of the groundwater alternatives include a passive remediation component which would operate over an extended time period.

EPA evaluated a number of remedial options for meeting the groundwater RAOs. The Feasibility Study screened technology types and process options to eliminate those which are not technically feasible at the site or that lack demonstrated effectiveness in treating one or more COCs Some of the remedial technologies/process options screened out included subsurface containment wall, phytoremediation, and air sparging. Technologies/process options which were retained after screening included natural attenuation, in-situ air stripping, pump and treat systems and permeable reaction walls. The FS then grouped the retained technologies into 5 alternatives In addition, a no-action alternative was included for evaluation (as required by CERCLA) to establish a baseline for comparison with the various remedial alternatives.

Two of the five groundwater alternatives each contained four different treatment and/or disposal process options. These options represented different approaches to meeting the RAOs. Thus, a total of ten remedial alternatives/options were given a detailed evaluation in the FS Report, in addition to the no-action alternative.

Subsequent to the Feasibility Study EPA made changes to the final remedial alternatives. Monitored natural attenuation (MNA) was reevaluated for effectiveness. MNA refers to a group of natural physical, chemical and biological processes, including· volatilization, dispersion, dilution, chemical reactions with substrate and biodegradation EPA concluded that MNA processes including biodegradation may have occurred in some parts of the upper aquifer, as evidenced by the decreasing concentrations of PCE at some locations and the presence of products that result from PCE decay. However, the available data collected for the site was insufficient to demonstrate biodegradation processes were occurring to a significant degree in all plumes. Therefore, EPA revised the evaluation of MNA to reflect the uncertainty of MNA's ability at the site to meet groundwater remedial goals. Also, the permeable reaction wall option for plume interception was reexamined. EPA dropped this option from further consideration because its' costs were significantly higher than the *in-situ* air stripping and pump and treat system options without a corresponding increase in overall protection of human health. Finally, EPA added treatment for Plume 2 to all final alternatives because the groundwater investigation in 2000 showed VOC contamination in Plume 2 was more extensive laterally and deeper than prior data indicated.

All of the final alternatives involving active remediation include source control measures in all of the groundwater plumes The purpose of active treatment is to reduce the concentrations of VOCs in the most highly contaminated groundwater areas to a significant extent in order to achieve significant progress towards meeting MCLs and to actively restrict future off-site movement of contaminated groundwater Since the risk-based remediation goals are more stringent than the MCLs, institutional controls, as discussed below, will be used to restrict future exposure.

For site groundwater outside of the source areas, the alternatives use natural processes (see Section 5.6.3) to reduce the VOC concentrations over time. These natural processes are expected to occur concurrently with the active remediation components of the alternatives, however, natural processes typically reduce groundwater VOC concentrations at a slower rate than treatment systems such as air stripping or pump and treat.

Groundwater modeling predicts that on-site contaminated groundwater may migrate in the future towards the northern site boundary (Lawnfield Road) and could move off-site. Therefore, the final alternatives except no action include measures to actively contain the potential future migration of contaminated groundwater along the northern property boundary of the site ("plume interception")

Elements Common to all Groundwater Alternatives

The final remedial alternatives contain some common elements that are briefly described below.

Long-term groundwater monitoring of all plumes is included in all alternatives (except the no action alternative). Monitoring would be performed to assess the progress of the remediation over time and allow adjustments to the remedy to be made as needed

A discount rate of 5 percent and a period of 30 years for operation and maintenance (O&M) were used for estimating costs. Although some remedial alternatives will require costs for longer time periods, for comparing costs a maximum period of 30 years was used, to provide a consistent basis for cost estimating. The cost estimates for each alternative are based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative Major changes may be documented in the form of a memorandum in the administrative record file, an explanation of significant differences, or a ROD amendment. The ROD estimate is an order-of-magnitude engineering cost estimate that is expected to be within -30 to +50 percent of the actual project cost.

Institutional controls to restrict domestic use of groundwater exceeding remediation goals are included in all action alternatives, because the alternatives may require a long period of time to achieve the RAOs These controls include, for example, restrictive easements, deed restrictions or property use restrictions. Alternatives that do not eliminate potential off-site contaminant movement in the future may require off-site institutional controls to limit human exposure to the off-site portion of the contaminated groundwater plume.

All remedial alternatives which involve construction activities would include erosion management controls during construction to protect the habitat of federally threatened fish species in downstream creeks from adverse impacts.

8.2 Groundwater Alternatives

8.2.1 Alternative G-1: No Action

The no action alternative provides a baseline for comparing other alternatives. It establishes the risk levels and site conditions if no remedial actions are implemented. No changes would be made to current site conditions. No engineering or institutional controls would be put in place and no remedial actions would be taken to reduce groundwater hazard levels at the site

Capital Cost:	$ 0
Annual Operation and Maintenance Cost:	$ 0

8.2.2 Alternative G-2: Monitored Natural Attenuation

This alternative relies solely on natural attenuation processes and long-term monitoring to reduce VOC concentrations and control contaminant migration. A total of 32 additional monitoring wells would be installed in and downgradient from the source areas for groundwater Plumes 1, 2, 3 and 4 (**Figure 8-1**). Samples would be collected annually from the monitoring wells and analyzed for VOCs, including PCE, TCE, DCE and vinyl chloride, and for parameters that indicate conditions supportive of natural attenuation processes to ensure that MNA would achieve cleanup goals.

Institutional controls such as property use restrictions on the western lot of Parcel A and Parcel B would be implemented to prevent future human exposure to groundwater contaminants from site redevelopment or well installation. Off-site institutional controls such as property use restrictions would be implemented at a future date if contaminated groundwater migrated to off-site areas.

Capital Cost:	$147,600
Annual Operation and Maintenance Cost:	$ 49,375
Operation and Maintenance Cost (Present Worth).	$858,586
Total Cost:	$1,006,186

Estimated Time to Attain RGs:>200 years on-site, >200 years offsite

8.2.3 Alternatives G-3a through G-3c: *In-situ* Air Stripping Source Control

These three alternatives use *in-situ* air stripping wells to treat groundwater in the highly contaminated source areas. These three alternatives are different in how they address the potential off-site movement of Plume 4. An *in-situ* air stripping well is a well in which air is injected into the groundwater at the bottom. As the air bubbles rise inside the well, volatile contaminants are transferred from the groundwater to the vapor phase The contaminated vapors are drawn off and treated above ground, while the aerated groundwater is recirculated within the aquifer. Groundwater is repeatedly circulated through the system until sufficient contaminant removal has taken place.

8.2.3.1 Alternative G-3a: *In-situ* Air Stripping Source Control/ Monitored Natural Attenuation Plume Interception

This alterative combines *in-situ* air stripping wells to remediate groundwater in the highly contaminated source areas of the groundwater plumes with monitored natural attenuation to reduce potential off-site contamination. A total of approximately 10 air stripping wells would be installed in the highest VOC concentration areas of Plumes 1, 2, 3 and 4 (**Figure 8-2**). The air stripping wells would be connected with pipes to five above-ground control buildings Vapor-phase VOCs would be collected from the air-stripping wells and treated with activated carbon to remove the VOCs before being discharged to the atmosphere. The used carbon is sent to a permitted facility for treatment and reuse

In-situ air stripping would be operated for a period of approximately 5 to 10 years. It is expected that the majority of the contamination in the source areas would be removed in five years. EPA may decide to operate the air stripping wells for longer than 5 years because this is a new technology and there is some uncertainty about how quickly contamination will be removed. EPA would use the results of periodic groundwater monitoring to evaluate how long to continue operating the air stripping wells

Natural attenuation mechanisms would be relied upon to reduce contaminant concentrations outside of the source areas of the plumes and to control off-site migration. No other actions would be taken to prevent contaminated groundwater from migrating off-site in the future Modeling predicts that on-site groundwater concentrations would exceed the remediation goals for approximately 90 years while undergoing natural attenuation. Therefore, monitoring would be conducted for 90 years to monitor the effectiveness of natural attenuation to reduce the groundwater VOC concentrations in the groundwater. Off-site monitoring wells also would be installed on the private property owned by KEX Radio north of the site. Modeling predicts that there is a potential for off-site groundwater exceedances of the remediation goals to a maximum distance of 100 feet north of Lawnfield Road for approximately 60 years. Therefore, groundwater samples would be taken annually for this time period and analyzed for VOC and degradation products (PCE, TCE, DCE and vinyl chloride), and for parameters that indicate conditions supportive of natural attenuation processes.

Institutional controls such as property use restrictions or restrictive easements on the western lot of Parcel A and Parcel B would be implemented to prevent future human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes

Capital Cost	$1,178,100
Annual Operation and Maintenance Cost:	$ 161,250
Operation and Maintenance Cost (Present Worth):	$1,498,624 (5 yr) to $1,929,255 (10 yr)*
Total Cost:	$2,676,724 (5 yr) to $3,107,355 (10 yr)

Estimated Time to Attain RGs: 90 years on-site, 60 years off-site

* O&M total costs are shown as a range depending on how long the air stripping wells operate.

8.2.3.2 Alternative G-3b: *In-situ* Air Stripping Source Control / *In-situ* Air Stripping Plume Interception (EPA's Selected Alternative)

This alternative uses *in-situ* air stripping wells to actively treat groundwater in the source areas of all plumes and to intercept Plume 4 at the northern boundary of the site from moving to off-site areas.

The *in-situ* air stripping systems for the source areas, and the associated on-site performance monitoring and modeling results, are the same as described for Alternative G-3a *In-situ* air stripping would be operated for a period of time (5 to 10 years) and in a manner similar to Alternative G-3a (**Figure 8-3**). Use of *in-situ* air stripping wells for the source areas is expected to more quickly achieve substantial reductions in VOC concentrations than the pump and treat alternatives evaluated by EPA. Following cessation of the air stripping wells, natural processes such as dilution, dispersion and absorption would occur to further reduce groundwater VOC concentrations on site until the remediation goals were attained

To prevent off-site migration of contaminated groundwater, an additional system of approximately four *in-situ* air stripping wells and an equipment building would be installed in the vicinity of Lawnfield Road. These *in-situ* air stripping wells would remove the volatile contaminants from groundwater before it moved off the site. The contaminated vapors collected by the wells would be treated with activated carbon to remove the VOCs before being discharged to the atmosphere. Actual VOC emissions would be negligible.

Institutional controls such as property use restrictions or restrictive easements on the western lot of Parcel A and Parcel B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes. The costs of the additional air stripping wells along Lawnfield Road are included in the following cost estimates.

Capital Cost:	$1,607,100
Annual Operation and Maintenance Cost:	$ 194,400
Operation and Maintenance Cost (Present Worth).	$2,103,342 (5 yr) to $2,533,972 (10 yr)
Total Cost:	$3,710,442 (5 yr) to $4,141,072 (10 yr)

Estimated Time to Attain RGs: 60 years on-site; immediately off-site because migration of groundwater contaminants is prevented.

* O&M total costs are shown as a range depending on how long the air stripping wells operate.

8.2.3.3 Alternative G-3c: *In-situ* Air Stripping Source Control/ Pump and Treat Plume Interception

This alternative uses *in-situ* air stripping wells to treat groundwater in the source areas of all plumes. This alternative would work like Alternative G-3a regarding the *in-situ* air stripping systems, monitoring and modeling, operations and number of years (**Figure 8-4**) Following cessation of the air stripping wells, natural processes such as dilution, dispersion and absorption would occur to further reduce VOC concentrations on site until the remediation goals were attained.

For this alternative, the off-site movement of Plume 4 contaminated groundwater would be prevented by a pump and treat system. A row of approximately 5 groundwater extraction wells would be installed in the vicinity of Lawnfield Road. Contaminated groundwater would be pumped out of these wells, rather than being allowed to move off the site. A combined pumping rate of 25 gpm would be sufficient to contain the plume from moving off-site across Lawnfield Road Extracted groundwater would be piped to an above-ground air stripper where volatile contaminants would be stripped from the groundwater. Chlorinated VOC emissions to the atmosphere from the air stripper are estimated to be about 6 lbs/year. About 13 million gallons per year of treated groundwater would be generated and discharged into the drainage channel along the western site boundary The air stripper effluent would be required to meet Oregon Water Quality Standards for the Willamette River Basin Periodic sampling of the air-stripper effluent would be conducted ensure that discharge criteria were met Also, samples would be collected from the extracted groundwater and from monitoring wells installed downgradient of Plume 4 to monitor the effectiveness of the groundwater extraction system.

Modeling predicts that it will take approximately 60 years to achieve the remediation goals Therefore, hydraulic containment at the northern site boundary would be required to operate for 60 years or until remediation goals are achieved. Modeling also predicts that on-site groundwater would exceed the remediation goals for approximately 60 years Therefore, on- and off-site monitoring would be required during these time periods.

Institutional controls such as property use restrictions or restrictive easements on the western lot of Parcel A and Parcel B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	$1,372,030
Annual Operation and Maintenance Cost	$ 190,500
Operation and Maintenance Cost (Present Worth):	$2,013,485 (5 yr) to $2,444,115 (10 yr)
Total Cost:	$3,385,505 (5 yr) to $3,816,135 (10 yr)

Estimated Time to Attain RGs: 60 years on-site; immediately off-site because migration of groundwater contaminants is prevented.

* O&M total costs are shown as a range depending on how long the air stripping wells operate.

8.2.4 Alternatives G-4a through G-4c: Pump and Treat Source Control

These alternatives share a common approach of using pump and treat systems to remediate groundwater in the source areas of all plumes, but differ in how they address the potential off-site movement of Plume 4.

8.2.4.1 Alternative G-4a: Pump and Treat Source Control/Monitored Natural Attenuation Plume Interception

This alternative uses pump and treat systems to remove and treat groundwater in the highly contaminated source areas of the site and monitored natural attenuation to control the potential off-site movement of Plume 4. A total of approximately eight groundwater extraction wells would be installed in Plumes 1, 2, 3 and 4 (**Figure 8-5**). These wells would be used to pump contaminated groundwater from below ground to above the ground where the groundwater is then piped to an air stripping system. The air stripper treats the groundwater by removing the volatile contaminants from the groundwater The total flow of extracted groundwater would be 35 gpm. Combined chlorinated VOC emissions from the air strippers to the atmosphere would be approximately 300 lb/year. About 18 5 million gallons per year of treated groundwater would be generated and discharged into the western drainage channel The air stripper effluent would be required to meet Oregon Water Quality Standards for the Willamette River Basin Periodic sampling of the air-stripper effluent would be conducted ensure that discharge criteria were met.

Pump and treat systems would be operated for a period of 30 years, which is the time period estimated to achieve federal and state drinking water MCLs within groundwater To further reduce contaminant concentrations below the MCLs to the risk-based remediation goals, natural processes on-site would be relied upon. Modeling predicts that on-site groundwater concentrations would exceed the remediation goals for approximately 70 years. Therefore, groundwater monitoring on site would occur during this time to monitor the performance of the pump and treat systems and natural processes.

Natural attenuation would be used to reduce contaminant concentrations outside of the source areas of the plumes and to control off-site movement of Plume 4. No other actions would be taken to prevent contaminated groundwater from moving off-site. The natural attenuation monitoring and institutional controls would be the same as those described for Alternative G-3a. Modeling predicts that there is a potential for groundwater exceeding the remediation goals to move off-site, to a maximum distance of 100 feet north of Lawnfield Road, for approximately 60 years Therefore, off-site monitoring of natural attenuation would be required for 60 years.

Institutional controls such as property use restrictions or restrictive easements on the western lot of Parcel A and Parcel B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	$464,670
Annual Operation and Maintenance Cost:	$124,900
Operation and Maintenance Cost (Present Worth):	$2,241,386
Estimated Total Cost:	$2,706,056

Estimated Time to Attain RGs. 70 years on-site; 60 years off-site

8.2.4.2 Alternative G-4b: Pump and Treat Source Control / *In-situ* Air Stripping Plume Interception

This alternative uses pump and treat systems to remove and treat groundwater in the highly contaminated source areas of the plumes and air stripping wells to control the potential off-site movement of Plume 4. The pump and treat systems and the associated performance monitoring and modeling are the same as described for Alternative G-4a (**Figure 8-6**) To further reduce contaminant concentrations below the MCLs to the risk-based remediation goals, natural processes on-site would be relied upon.

To prevent off-site migration of contaminated groundwater, a series of *in-situ* air stripping wells would be installed in the vicinity of Lawnfield Road. These *in-situ* air stripping wells would operate to strip the volatile contaminants from groundwater before it moved off-site. The contaminated vapors collected by the wells would be treated with activated carbon to remove the VOCs before being discharged to the atmosphere.

Modeling predicts that there is a potential for groundwater exceeding the remediation cleanup goals to move off-site, to a maximum distance of 100 feet north of Lawnfield Road, for approximately 60 years Therefore, *in-situ* air stripping for plume interception may be required at the northern property boundary for 60 years. Monitoring wells would be installed downgradient of Plume 4 to detect off-site contaminant movement and groundwater samples would be taken annually and analyzed to monitor the effectiveness of the *in-situ* air stripping wells.

Institutional controls such as property use restrictions or restrictive easements on the western lot of Parcel A and Parcel B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	$959,670
Annual Operation and Maintenance Cost:	$156,800
Operation and Maintenance Cost (Present Worth).	$2,828,730
Total Cost	$3,788,400

Estimated Time to Attain RGs: 60 years on-site; immediately off-site because migration of groundwater contaminants is prevented.

8.2.4.3. Alternative G-4c: Pump and Treat Source Control / Pump and Treat Plume Interception

This alternative uses pump and treat systems to remove and treat groundwater in the highly contaminated source areas of all plumes and to control the potential off-site movement of Plume 4. The pump and treat systems configuration, monitoring and modeling for the source areas are the same as described for Alternative G-4a (**Figure 8-7**) To further reduce contaminant concentrations below the MCLs to the risk-based remediation goals, natural processes on-site would be relied upon

Under this alternative, off-site movement of contaminated groundwater would be prevented by installing a pump and treat system just south of Lawnfield Road. The pump and treat system configuration for plume interception, and the monitoring and modeling are the same as described for Alternative G-3c.

Modeling predicts that there is a potential for groundwater exceeding the provisional cleanup goals to move off-site, to a maximum distance of 100 feet north of Lawnfield Road, for approximately 60 years. Therefore, a pump and treat system at the northern property boundary may be required for 60 years. Modeling also predicts that on-site groundwater would exceed the remediation goals for approximately 70 years. Therefore, on-site monitoring would be required for this amount of time.

Institutional controls such as property use restrictions or restrictive easements on the western lot of Parcel A and Parcel B would be implemented to limit human exposure to on-site groundwater contaminants and to ensure access for monitoring purposes.

Capital Cost:	$654,000
Annual Operation and Maintenance Cost:	$153,900
Operation and Maintenance Cost (Present Worth):	$2,769,538
Total Cost:	$3,423,538

Estimated Time to Attain RGs· 70 years on-site; immediately off-site because migration of groundwater contaminants is prevented

8.2.5 Alternatives G-5: Site-Wide Pump and Treat

This alternative uses a pump and treat system to remove and treat all on-site groundwater that exceeds the remediation goals (**Figure 8-8**) The groundwater extraction system would include a total of 15 extraction wells, with a combined flow of 150 gpm.

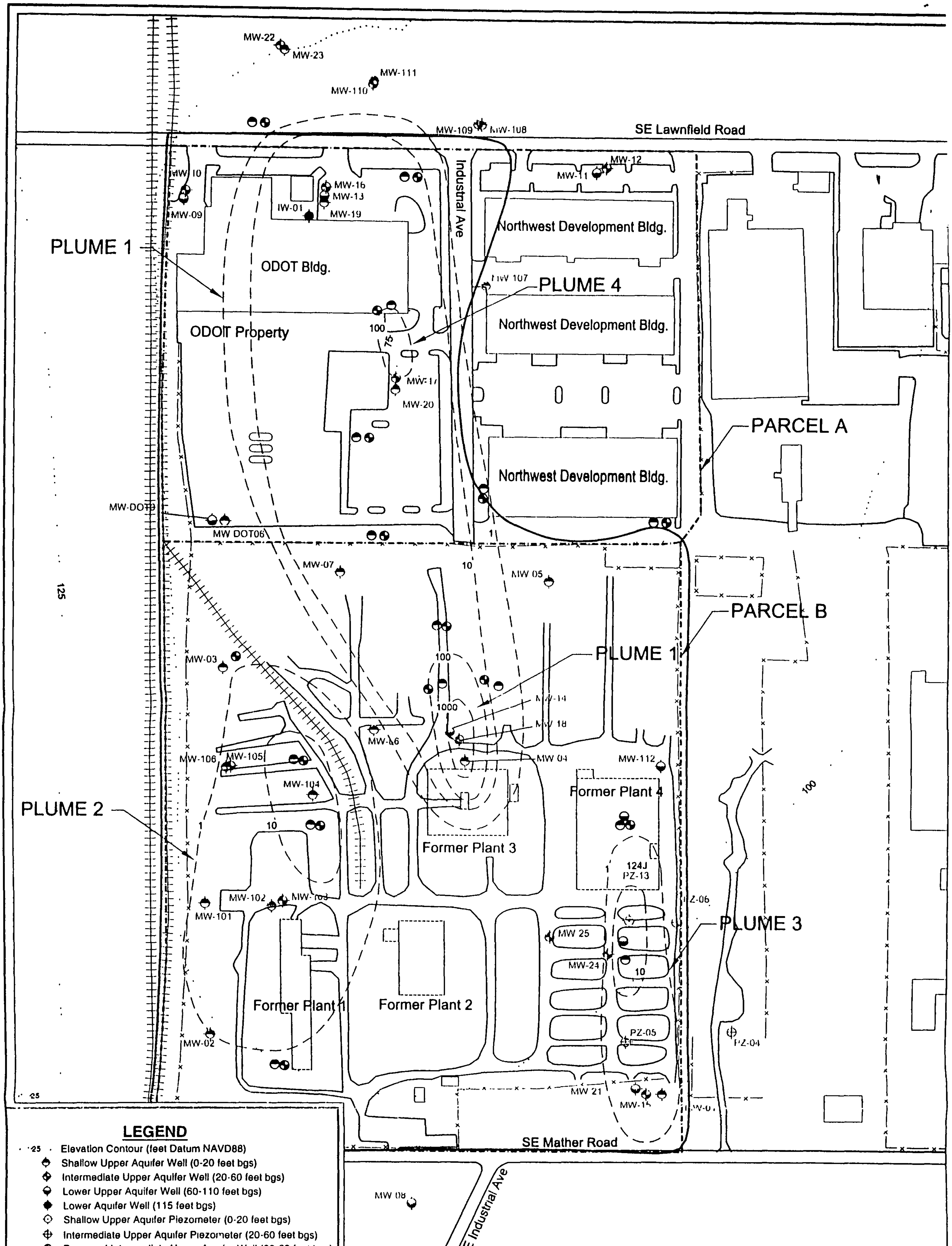
Extracted groundwater would be piped to an above-ground air stripper where volatile contaminants would be stripped from the groundwater Because of the distances between extraction wells, two treatment systems would be needed. Chlorinated VOC emissions from the air strippers to the atmosphere are estimated to be about 330 lbs/year. About 80 million gallons per year of treated groundwater would be generated and discharged into the western drainage channel. The air stripper effluent would be required to meet Oregon Water Quality Standards for the Willamette River Basin. Periodic sampling of the air-stripper effluent would be conducted ensure that discharge criteria were met

Groundwater monitoring would be conducted to monitor the decrease in groundwater VOC concentrations resulting from the pump and treat systems. Based on groundwater modeling, site cleanup would require the pump and treat system to operate for approximately 30 to 40 years. Because the extraction wells along the northern property boundary provide hydraulic containment, no off-site exceedances of the remediation goals are predicted.

Institutional controls on the western lot of Parcel A and Parcel B would be implemented to limit human exposure to on-site groundwater contaminants during the time period of treatment and to ensure access for monitoring purposes.

Capital Cost:	$795,420
Annual Operation and Maintenance Cost:	$191,400
Operation and Maintenance Cost (present worth).	$3,441,757
Total Cost:	$4,237,177

Estimated Time to Attain RGs 30-40 years on-site, immediately off-site because migration of groundwater contaminants is prevented



LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0-20 feet bgs)

0 50 100 200
SCALE IN FEET

PLANT NORTH 19°

NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations
2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999
3) Contour interval units in ug/L

Figure 8-1
Northwest Pipe and Casing
Alternative G2 - Monitored Natural Attenuation

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM

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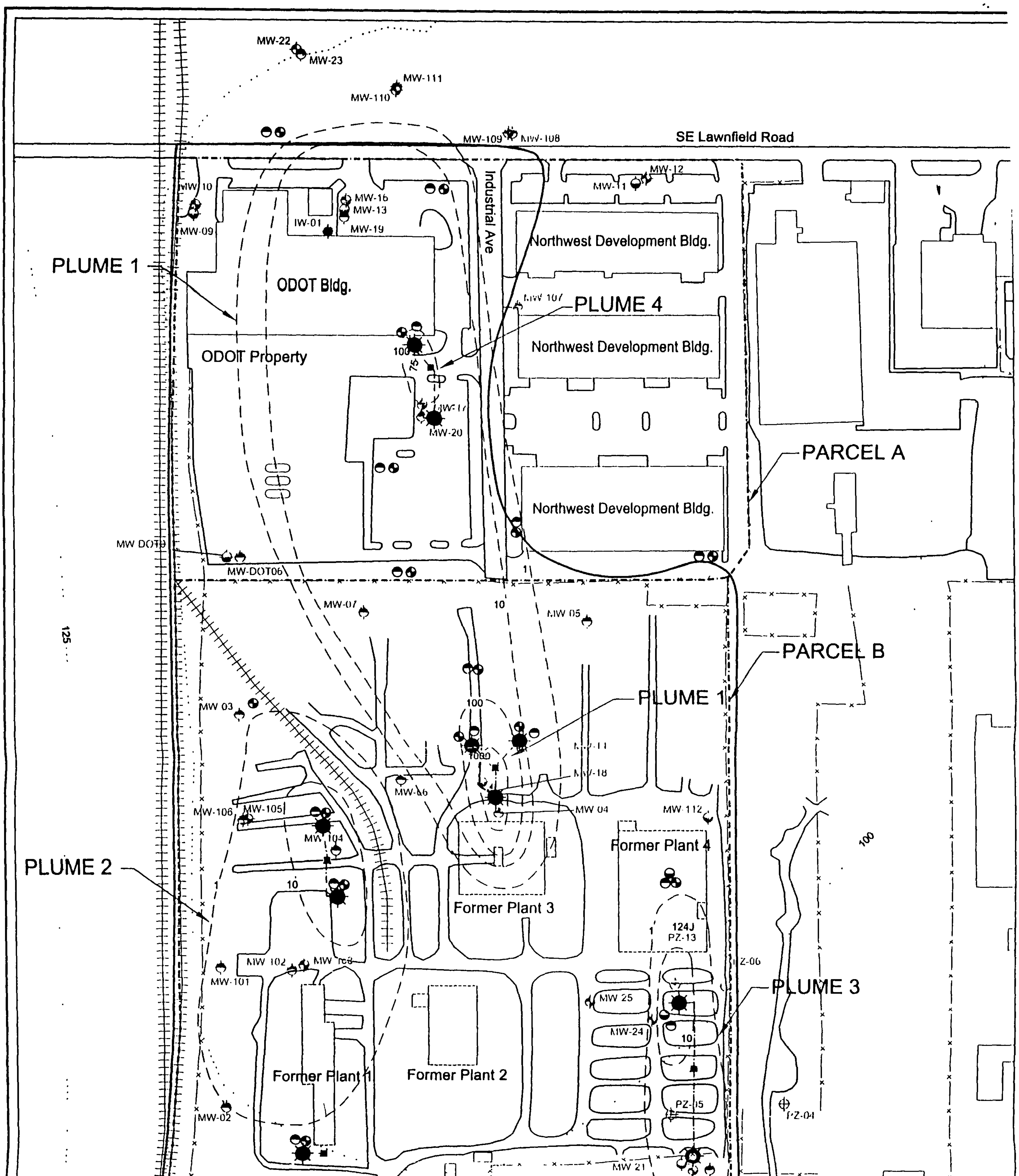

LEGEND

- 125 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0-20 feet bgs)
- In Situ Air Stripping Equipment Building
- Piping
- In Situ Air Stripping Well (bottom at 50 feet bgs)
- In Situ Air Stripping Well (bottom at 70 feet bgs)

PLANT NORTH 19°

0 50 100 200
SCALE IN FEET

NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations

2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999

3) Contour interval units in ug/L

Figure 8-2
Northwest Pipe and Casing
Alternative G3a - In Situ Air Stripping Source Control and Monitored Natural Attenuation

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) & GW INVESTIGATION ADDENDUM

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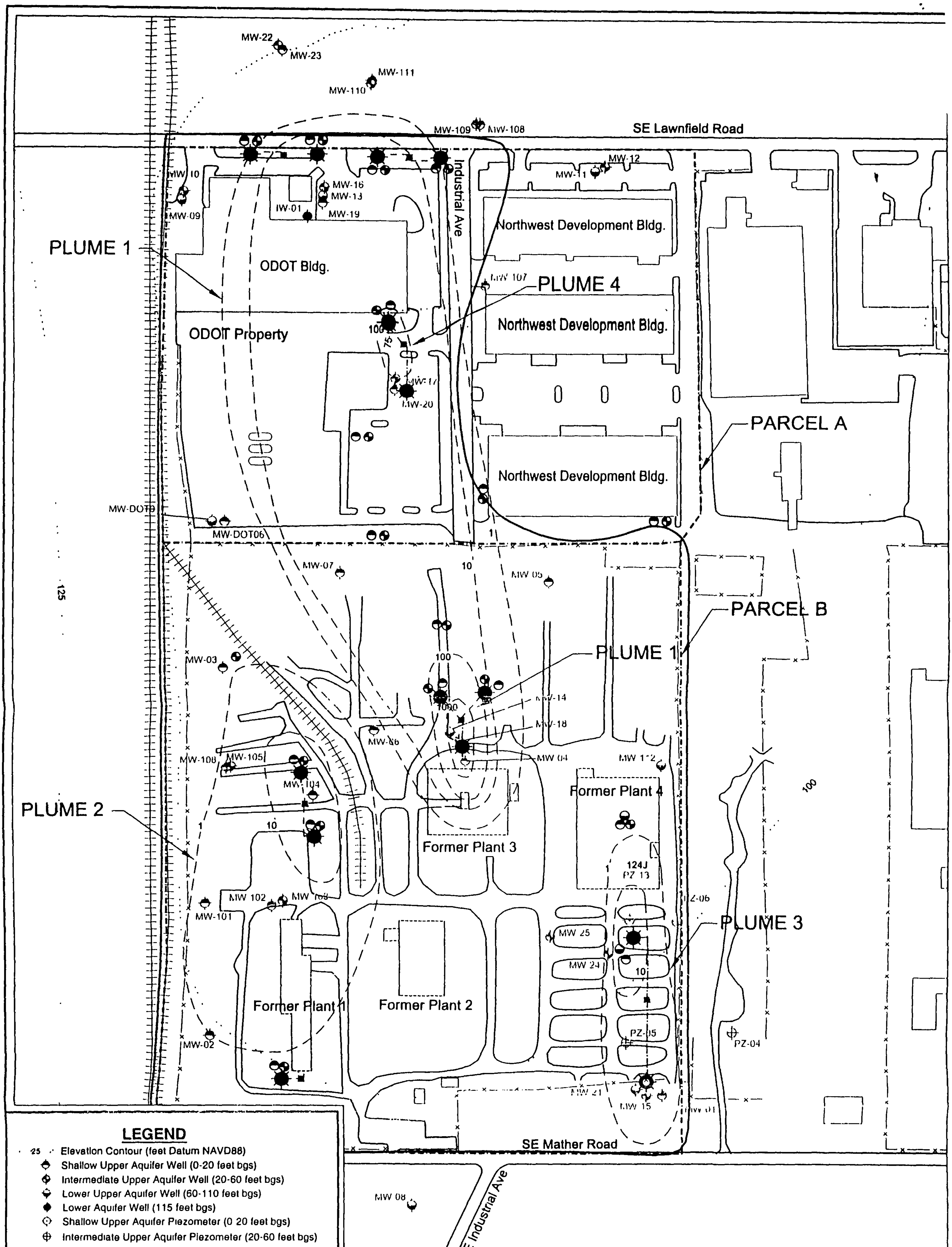

LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0 20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0-20 feet bgs)
- In Situ Air Stripping Equipment Building
- Piping
- In Situ Air Stripping Well (bottom at 50 feet bgs)
- In Situ Air Stripping Well (bottom at 70 feet bgs)

NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations

2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999

3) Contour interval units in ug/L

Figure 8-3
Northwest Pipe and Casing
Alternative G3b - In Situ Air Stripping Source Control and In Situ Air Stripping Plume Interception

EPA REGION 10

030-RI CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) & GW INVESTIGATION ADDENDUM

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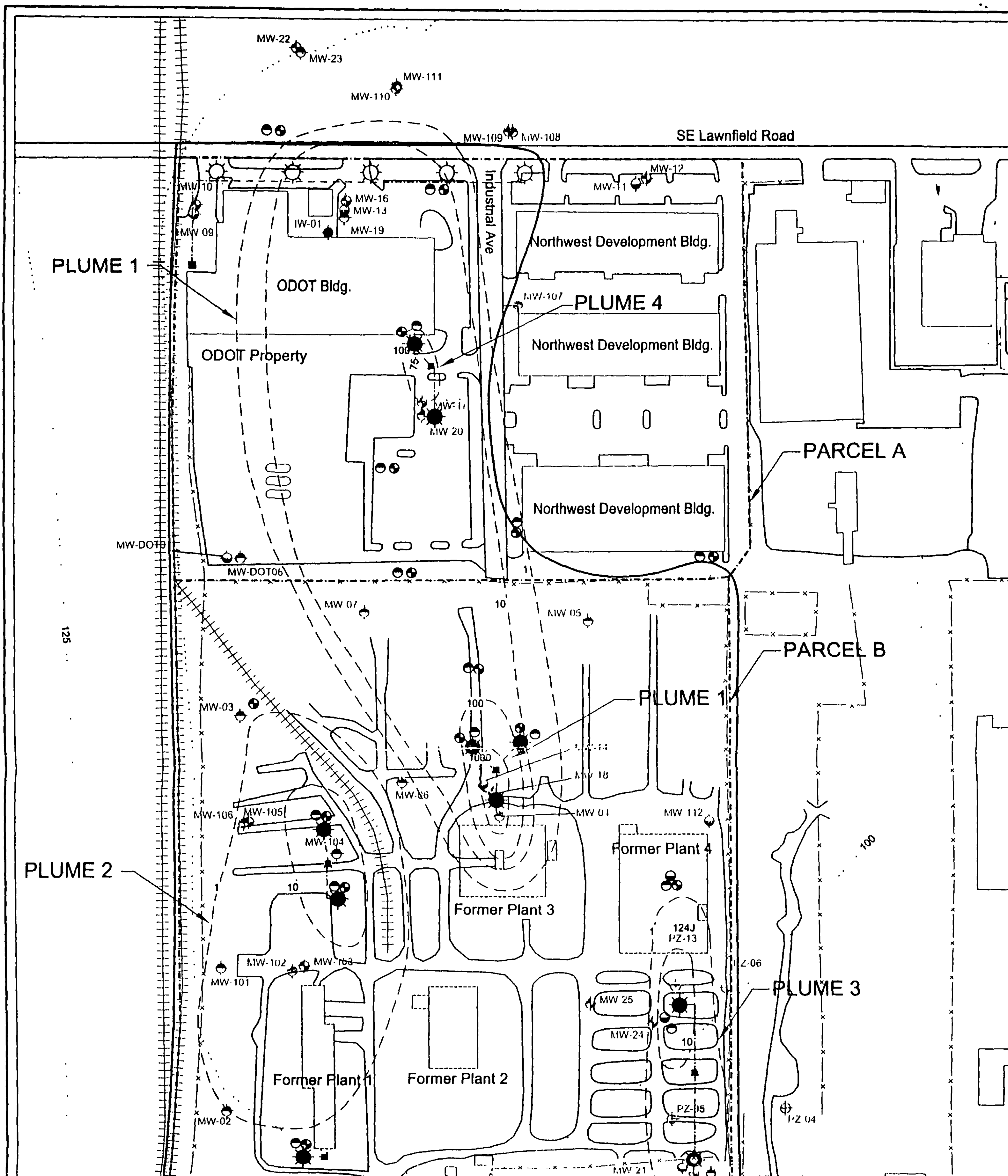


LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0-20 feet bgs)
- In Situ Air Stripping Equipment Building
- Piping
- In Situ Air Stripping Well (bottom at 50 feet bgs)
- In Situ Air Stripping Well (bottom at 70 feet bgs)
- Extraction Well (bottom of well at 30 feet bgs)
- Air Stripper System

PLANT NORTH 19°

0 50 100 200
SCALE IN FEET

NOTES

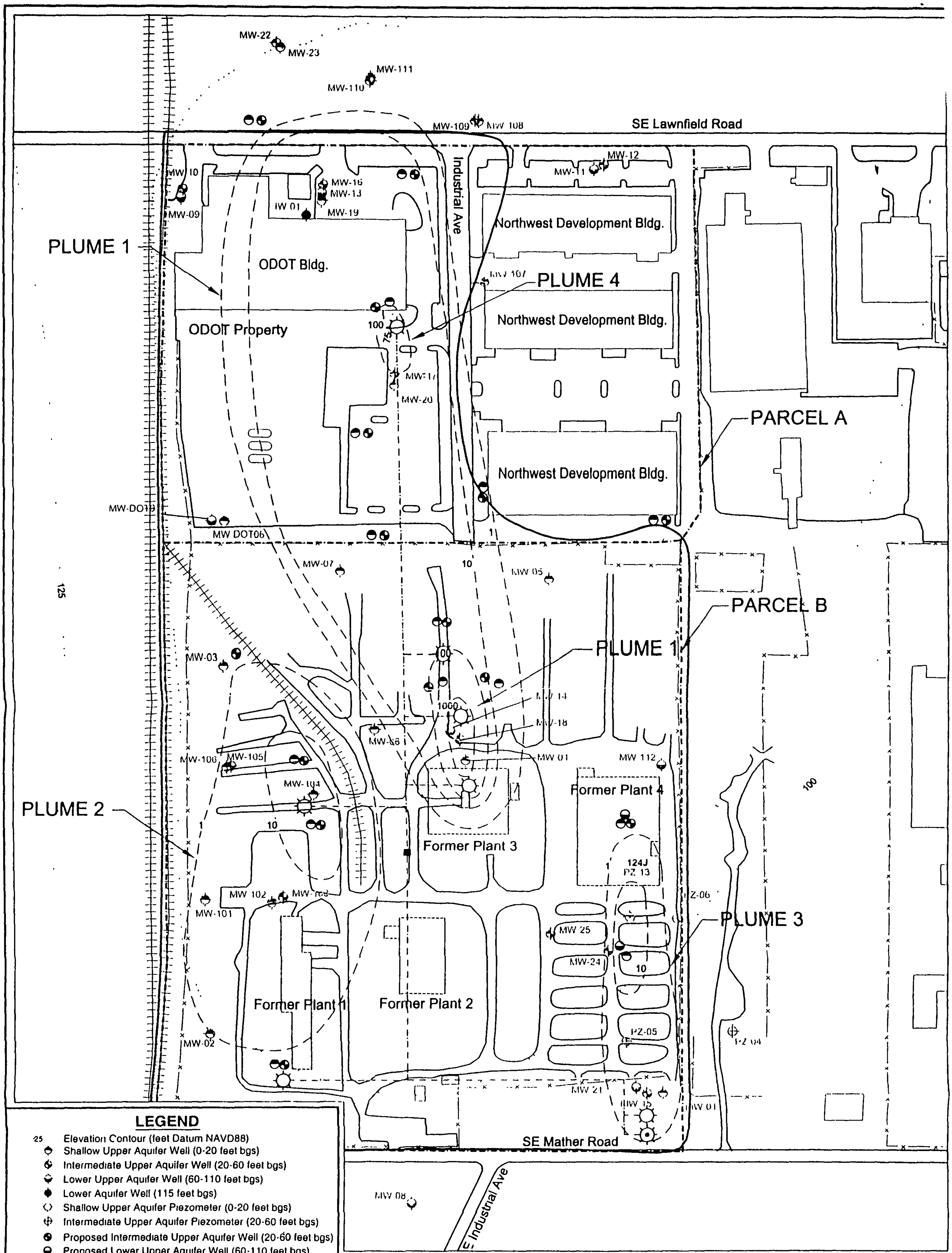
1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations
2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999
3) Contour interval units in ug/L

Figure 8-4
Northwest Pipe and Casing
Alternative G3c - In Situ Air Stripping Source Control and Pump and Treat Plume Interception

EPA REGION 10

Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM

FILENAME: T\RAC\NWP&C\Sub-Tasks\Annual GW 2000\Alt G-3c dwg
EDIT DATE 01/18/01 AT 13 45



LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0-20 feet bgs)
- Piping
- Extraction Well (bottom of well at 30 feet bgs)
- Air Stripper System
- Extraction Well (bottom of well at 50 feet bgs)

PLANT NORTH 19°

0 50 100 200
SCALE IN FEET

NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations

2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999

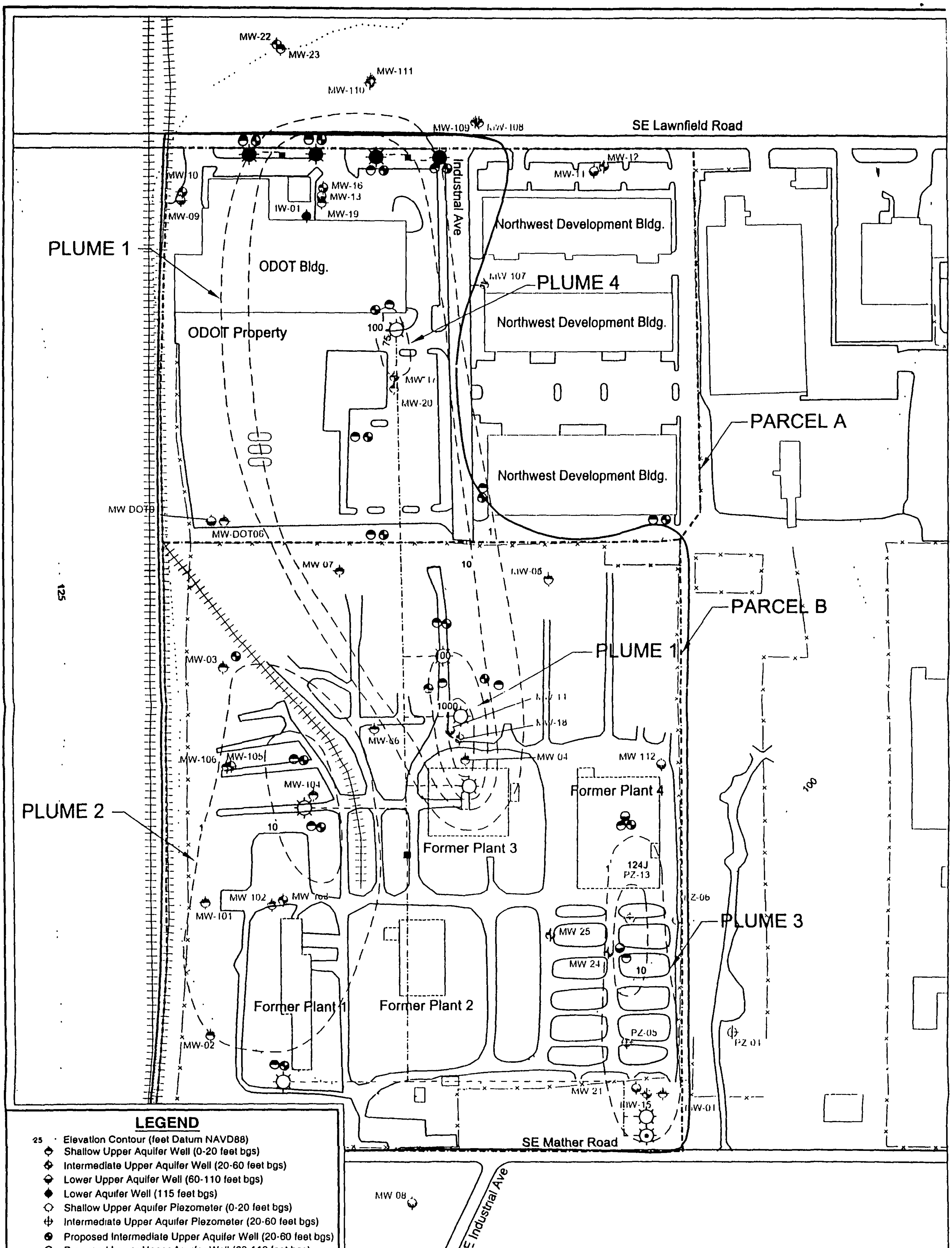
3) Contour interval units in ug/L

Figure 8-5
Northwest Pipe and Casing
Alternative G4a - Pump and Treat Source Control and Monitored Natural Attenuation

EPA REGION 10

Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM

FILENAME T\RAC\NWP&C\Sub-Tasks\Annual GW 2000\All G-4a dwg
EDIT DATE 01/18/01 AT 1 47



LEGEND

- 25 · Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0-20 feet bgs)
- Extraction Well (bottom of well at 30 feet bgs)
- Air Stripper System
- Extraction Well (bottom of well at 50 feet bgs)
- Piping
- In Situ Air Stripping Well (bottom at 50 feet bgs)

PLANT NORTH 19°

0 50 100 200

SCALE IN FEET

NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations

2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999

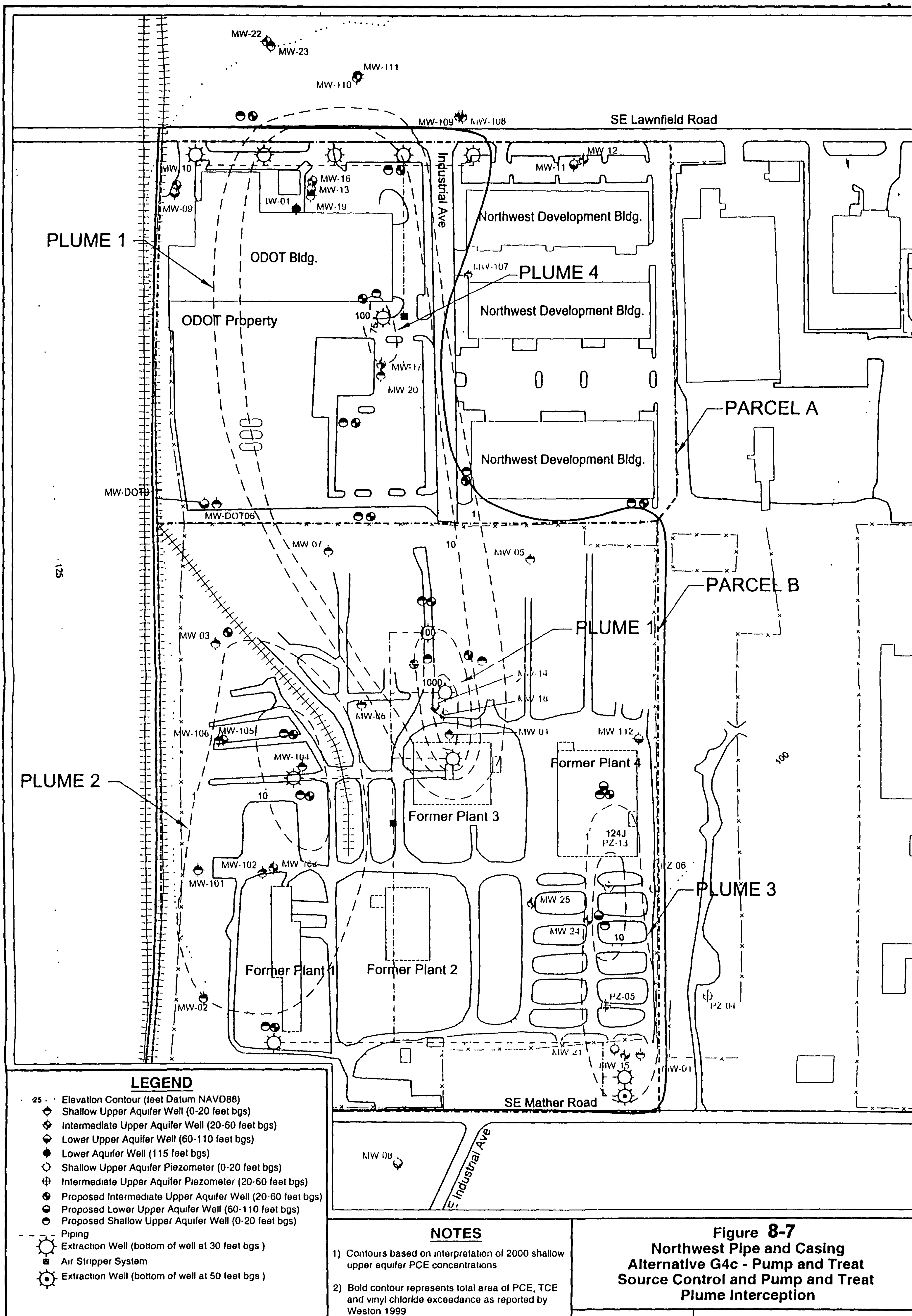
3) Contour interval units in ug/L

Figure 8-6
Northwest Pipe and Casing
Alternative G4b - Pump and Treat Source Control and In Situ Air Stripping Plume Interception

EPA REGION 10

Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM

FILENAME T:\RAC\NWP&C\Sub-Tasks\Annual GW 2000\Alt G-4b.dwg
EDIT DATE 01/18/01 AT 13:49



NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations

2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999

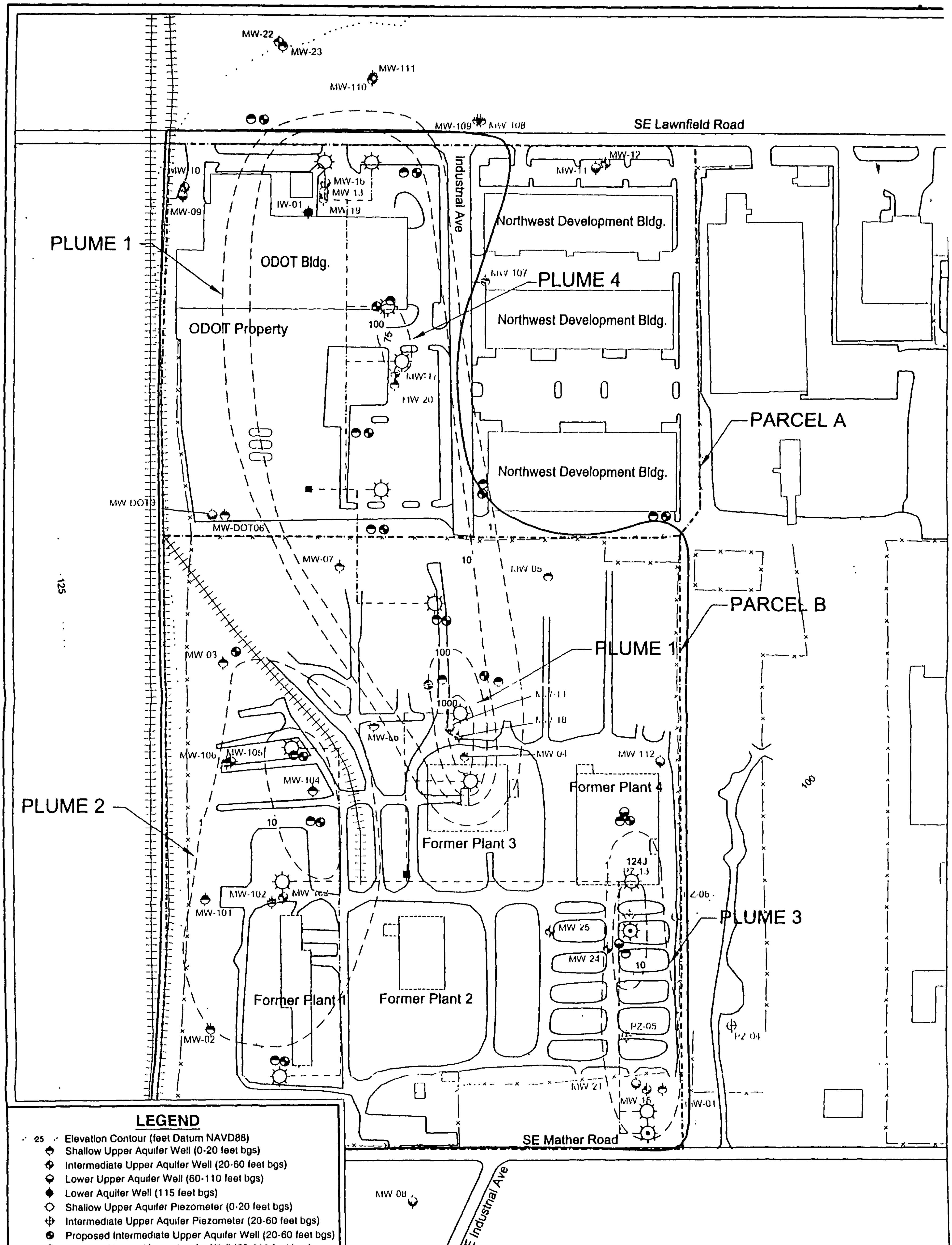
3) Contour interval units in ug/L

Figure 8-7
Northwest Pipe and Casing
Alternative G4c - Pump and Treat Source Control and Pump and Treat Plume Interception

EPA REGION 10

Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) &
GW INVESTIGATION ADDENDUM

FILENAME T:\RAC\NWP&C\Sub-Tasks\Annual GW 2000\Alt G-4c dwg
PLOT DATE 01/18/01



LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0-20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0 20 feet bgs)
- Piping
- Extraction Well (bottom of well at 30 feet bgs)
- Air Stripper System
- Extraction Well (bottom of well at 50 feet bgs)

PLANT NORTH 19°

0 50 100 200
SCALE IN FEET

NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations
2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999
3) Contour interval units in ug/L

Figure 8-8
Northwest Pipe and Casing
Alternative G5 - Site Wide Pump and Treat

EPA REGION 10

Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) & GW INVESTIGATION ADDENDUM

FILENAME T:\RAC\NWP&C\Sub-Tasks\Annual GW 2000\Alt G-5.dwg

9.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

EPA has established nine criteria for the evaluation of remedial alternatives:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

The following subsections evaluate the groundwater remedial alternatives according to the nine NCP evaluation criteria. Costs of the groundwater alternatives are summarized in **Table 9-1** Each groundwater remedial alternative is discussed in terms of the evaluation criteria to help identify a selected alternative for the Northwest Pipe & Casing Site The no-action alternative (Alternative G-1) was included for a baseline comparison For each criterion, the alternative that performs best is discussed first, with the remaining alternatives discussed in sequence.

9.1 Overall Protection of Human Health and the Environment - *Determines whether a remedial action eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.*

All of the alternatives except the "no action" alternative would provide adequate protection of human health and the environment from direct contact with groundwater contaminants by eliminating, reducing, or controlling risk through engineering and/or institutional controls. However, some alternatives provide more protection than others. Alternative G-5 (site-wide pump and treat) is most protective of human health and the environment because it would reduce contamination across the entire site and is predicted to meet site RAOs in the shortest time period (30 to 40 years). Alternatives G-3b and G-3c, which use *in-situ* air stripping for source control, are considered more protective than G-4b and G-4c (pump and treat), because *in-situ* air stripping is expected to reduce high VOC concentrations in the source areas more quickly than pump and treat. Alternatives G-3a and G-4a are less protective because they depend on natural attenuation to control movement of the plume and may not be effective enough. Alternative G-2 is significantly less protective because it relies on institutional controls and natural attenuation over a time period of 200 years to reduce risks. Alternative G-1 (no action) is not protective because no controls are taken to prevent exposure to contaminated groundwater. For all alternatives (except no action), the effectiveness of the alternative is ultimately dependent on how well the institutional controls prevent exposure to contaminated groundwater until the cleanup goals are achieved

9.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) - *Evaluates whether a remedial action meets state and federal environmental laws and regulations that pertain to the site*

All alternatives, except G-1 (no action), would be designed to meet their respective ARARs from Federal and State laws. Although all alternatives would eventually meet both federal drinking water MCLs and the more stringent remediation goals based on the state environmental cleanup regulations, the time periods until these levels are achieved vary considerably Alternative G-5 would attain remediation goals on-site within 30 to 40 years. Under Alternatives G-3b and G-4b, remediation goals would be met after approximately 60 years. Alternatives G-3a and G-4a would attain the remediation goals on-site in approximately 90 years, while G-3c and G-4c would require 70 years. Alternative G-2 would require more than 200 years to attain the cleanup levels. Alternatives G-3b, G-3c, G-4b, G-4c and G-5 would meet remediation goals off-site immediately. Alternatives G-3a and G-4a, which include natural attenuation for off-site plume control, are estimated to require 60 years to meet the remediation goals off-site.

9.3 Long-Term Effectiveness and Permanence - *Considers the ability of a remedial action to maintain protection of human health and the environment over time and the reliability of such protection.*

Alternative G-5 and the *in-situ* air stripping alternatives, G-3b and G-3c, have the highest long-term effectiveness because they would permanently reduce risks associated with the source areas of the contaminated groundwater and prevent off-site risks by preventing off-site migration of Plume 4. Pump and treat source control alternatives (G-4b and G-4c) are considered less effective than *in-situ* air stripping because they can exhibit an impaired ability to reduce contaminant levels over time ("tailing effect"). Alternatives G-2, G-3a and G-4a are less effective because site conditions may not support natural attenuation processes over time and off-site migration of Plume 4 may occur. Alternative G-1 (no action) is the least effective and permanent because site risks would not be reduced.

9.4 Reduction of Toxicity, Mobility and Volume Through Treatment - *Evaluates a remedial action's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment and the amount of residual contamination remaining.*

Alternatives G-3b, G-3c, G-4b, and G-4c which use treatment for both source control and plume interception, would achieve substantial reductions in the toxicity and volume of contaminated groundwater in the source areas and reduce the mobility of contaminants in the northern portion of the site, preventing off-site movement. Alternative G-5 (site-wide pump and treat) would most effectively reduce contaminant toxicity, mobility and volume because it would treat groundwater in all areas on the site. Alternatives G-3a and G-4a, which use natural attenuation for controlling plume movement, are considered less effective in meeting this criterion because natural attenuation processes may not be occurring to a sufficient degree and extent across the entire site. Alternative G-1 and G-2 involve no treatment to reduce contaminant toxicity, mobility and volume within a reasonable time frame.

9.5 Short-Term Effectiveness - *Considers how fast a remedial action reaches the cleanup goal and the risk that the remedial action poses to workers, residents, and the environment during the construction or implementation of the remedial action.*

The *in-situ* air stripping Alternatives G-3a, G-3b and G-3c have the potential to achieve significant reductions in contaminant concentrations in the source areas within five years, although time to reach the remediation goals across the entire site would be around 60 years. Alternative G-5, site-wide pump and treat, would meet remediation goals across the site in approximately 30-40 years but is not expected to achieve early reductions in VOCs as quickly as G-3a or G-3b. Natural attenuation alternatives (G-2, G-3a and G-4a) require up to 200 years to attain the remediation goals and may not meet the goal of preventing off-site migration of Plume 4.

During implementation of the groundwater remedial action, *in-situ* air stripping Alternatives G-3a, G-3b and G-3c would pose a low risk to on-site workers because the contaminated groundwater is kept below-ground and not handled directly by workers The vapors extracted from these *in-situ* wells, containing volatile contaminants stripped from the groundwater, could pose potential risks to workers if released to the atmosphere; the likelihood of this exposure is minimal because the vapors would be collected under negative pressure (vacuum) and then treated prior to release to the atmosphere Pump and treat Alternatives G-5 and G-4a, G-4b and G-4c pose a greater risk to on-site workers due to handling untreated groundwater and from contaminant releases from a failure of the water conveyance system or an upset in the air stripping system. Personal health and safety protection measures would minimize this risk. Construction of the pump and treat system alternatives and the *in-situ* air stripping alternatives could pose a potential for short-term worker exposure to contaminants in drill cuttings (subsurface soil) associated with constructing the wells. Workers would be required to wear appropriate levels of protection to minimize exposure during construction activities.

9.6 Implementability - *Considers the technical and administrative feasibility of implementing a remedial action, such as relative availability of goods and services. This criterion also considers whether the technology has been used successfully at other similar sites*

Alternative G-1 requires no implementation. Alternative G-2 is the second easiest to implement because it requires only groundwater monitoring and on-site institutional controls. *In-situ* air stripping alternatives (G-3a, G-3b and G-3c) would be easier to implement than pump and treat (G-4a, G-4b and G-4c) because they do not require aboveground systems for handling untreated and treated groundwater and they would be operated for a shorter period of time Also, the pump and treat alternatives may be less feasible to implement over time because the proposed Sunrise Corridor highway project, estimated to begin in 10 years, may require abandonment and relocation of extraction wells. Site-wide pump and treat (G-5) would be the most difficult to implement because it would require extensive equipment, and construction, operation and maintenance effort due to the size and area extent of the system. Additionally, it would require aboveground handling of larger volumes of contaminated groundwater, and would require extensive coordination with the proposed Sunrise Corridor highway construction due to the large number of extraction wells.

The institutional controls identified for all alternatives except G-1(No Action) are expected to be readily obtainable and enforceable. They consist of restrictive easements, deed restrictions or property use restrictions on Parcel B and the ODOT portion of Parcel A for access to construct, operate and maintain the remedy treatment systems and control groundwater use until remediation goals are achieved. Parcel B is presently owned by DEQ, as trustee for EPA, and since the state supports the remediation goals of the groundwater ROD, placing institutional controls for property access and for limiting groundwater use on Parcel B should be obtainable. The ODOT property will need to have similar institutional controls for the same purposes Some of these institutional controls may require more time to obtain, due to the need for coordination of access for remedy construction and operational activities with the on-going operations at the ODOT Lawnfield Road Maintenance Facility. Nevertheless, EPA expects ODOT will cooperate with EPA to allow placement of the necessary institutional controls.

9.7 Cost - *Includes estimated capital, operation and maintenance costs.*

The total costs of the groundwater alternatives are summarized in **Table 9- 1.** These costs include both capital and operation and maintenance expenditures. Costs are estimated for purposes of comparison and are considered to be accurate within -30 to +50 percent. The net present value of each alternative is calculated using a discount rate of 5 percent and an operation and maintenance period of 30 years.

No costs are associated with Alternative G-1 Alternative G-2, site-wide MNA, is the least costly of all action alternatives ($1 M) There is negligible cost difference between using *in-situ* air stripping (for 5 years) vs. pump and treat for source control (G-3a vs G-4a, G-3b vs G-4b, and G-3c vs. G-4c); if *in-situ* air stripping is used for 10 years, then its costs are estimated to be approximately 10 percent higher than pump and treat In regard to addressing future off-site plume interception, MNA alternatives (G-3a and G-4a) are less costly than pump and treat (G-3c and G-4c) which are less costly than *in-situ* air stripping (G-3c and G-4c). Site-wide pump and treat, G-5, has the highest estimated cost.

9.8 State Acceptance

The Oregon Department of Environmental Quality supports Alternative G-3b, *In-situ* Air Stripping Source Control / *In-situ* Air Stripping Plume Interception, which is EPA's Selected Remedy.

9.9 Community Acceptance

A responsiveness summary of the comments is provided in Appendix A of this document.

Two comments from the Oregon Department of Transportation and the Clackamas County Water Environment Services were submitted during the public comment period . ODOT requested that EPA coordinate closely with the ODOT Lawnfield Road Maintenance Facility personnel on the locations for placement of the air stripping wells and support equipment sheds, since the facility is an on-going operation. Clackamas County recommended EPA avoid ground-disturbing activities within 50 feet of drainage ditch banks and requested notification if fluids are discharged to surface waters during the groundwater remedial action.

Table 9-1
Summary of Costs for Groundwater Alternatives

Alt No.	Description	Capital Cost	Annual O&M Cost	Present Worth of O&M [1]	Total Present Worth [1]
G-1	No Action	$0	$0	$0	$0
G-2	Monitored Natural Attenuation	$147,600	$49,375	$858,586	$1,000,186
G-3a	*In-situ* Air Stripping and Monitored Natural Attenuation	$1,178,100	$161,250	$1,498,624 (5-yr) $1,929,255 (10-yr)	$2,676,724 (5-yr) $3,107,355 (10-yr)
G-3b	*In-situ* Air Stripping	$1,607,100	$194,400	$2,103,342 (5-yr) $2,533,972 (10-yr)	$3,710,442 (5-yr) $4,141,072 (10-yr)
G-3c	*In-situ* Air Stripping and Pump and Treat	$1,372,030	$190,500	$2,013,485 (5-yr) $2,444,115 (10-yr)	$3,385,505 (5-yr) $3,816,135 (10-yr)
G-4a	Pump and Treat and Monitored Natural Attenuation	$464,670	$124,900	$2,241,386	$2,706,056
G-4b	Pump and Treat and *In-situ* Air Stripping	$959,670	$156,800	$2,828,730	$3,788,400
G-4c	Pump and Treat	$654,000	$153,900	$2,769,538	$3,423,538
G-5	Site-wide Pump and Treat	$795,420	$191,400	$3,441,757	$4,237,177

[1]Some alternatives display a range of O&M costs and total costs based on two time periods, 5 years and 10 years, because the exact time needed for operation of the *in-situ* air stripping treatment systems is unknown at this time.

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10.0 THE SELECTED REMEDY

10.1 SUMMARY OF THE RATIONALE FOR THE SELECTED REMEDY

Based on consideration of the CERCLA requirements and analysis of alternatives using the nine evaluation criteria, including public comment, EPA has determined that the following alternative constitutes the most appropriate remedy for the Northwest Pipe and Casing Company Superfund Site groundwater operable unit (OU 2):

- Alternative G-3b consisting of *in-situ* air stripping wells to treat groundwater in the source areas of the upper aquifer groundwater plumes and at the northern boundary of the site to prevent off-site migration (see **Figures 10-1 and 10-2**). Groundwater monitoring wells will be installed to evaluate the effectiveness of *in-situ* air stripping and measure the progress towards achieving groundwater cleanup goals. During construction activities, erosion control measures will be taken to minimize impacts to surface water quality and critical habitat of federally listed threatened or endangered anadromous fish. Until groundwater remediation goals are met, access to and use of upper aquifer groundwater on the western lot of Parcel A and Parcel B will be limited and controlled through institutional controls including a restrictive covenant which will run with the land.

The primary factors in selecting this alternative include: providing substantial lasting protection to human health and the environment through treatment of the high VOC-concentration groundwater to reduce the toxicity, mobility or volume of contaminated groundwater; minimizing the short-term risks posed by the groundwater remedy during its operation by keeping contaminated groundwater below ground and away from contact with people while it undergoes treatment; and readily implementable systems which present fewer obstacles to future redevelopment of the site.

Other alternatives considered may: afford a greater degree of human health protection, such as Alternative G-5, by actively treating all groundwater at the site; be easier to implement, such as Alternative G-2, by not requiring construction of any treatment systems; or have substantially lower construction costs, such as Alternative G-2. However, as compared to the other alternatives, Alternative G-3b offers the best balance of providing lasting human health risk reduction by using treatment to reduce the toxicity, mobility or volume of hazardous substances in the groundwater, in a cost-effective and readily implementable manner that facilitates returning the site to future productive reuse.

10.2 DESCRIPTION OF THE SELECTED GROUNDWATER REMEDY

- Installing approximately ten *in-situ* air stripping treatment wells in the highest VOC concentration areas of upper aquifer Plumes 1, 2, 3 and 4. The air stripping wells would be connected with pipes to an estimated five small above-ground control buildings, which would house a blower, vapor extractor and an activated carbon canister for vapor treatment.

- Using natural processes, including volatilization, dispersion, dilution, absorption and chemical reactions with subsurface materials to reduce the VOC concentrations in groundwater outside of the source areas.

- Installing groundwater monitoring wells in the vicinities of the treatment wells to evaluate their effectiveness over time in reducing VOC concentrations in the groundwater. Locations of treatment wells and appurtenances on the ODOT property will be coordinated with ODOT.

- Installing and annually sampling additional groundwater monitoring wells to evaluate progress towards attaining groundwater remediation goals To ensure that the remediation goals continue to be maintained after attainment, groundwater monitoring will continue annually for the first five years after attainment and then every five years thereafter.

- Installing a system of approximately four *in-situ* air stripping wells and an equipment building in the vicinity of Lawnfield Road. These *in-situ* air stripping wells would remove the volatile contaminants from groundwater before it moved off the site. The contaminated vapors collected by the wells would be treated with activated carbon to remove the VOCs before being discharged to the atmosphere. Spent carbon will be tested to determine if it is a hazardous waste and will require special handling.

- Operating the *in-situ* air stripping wells for a minimum period of five years, during which EPA expects that groundwater VOC concentrations in the source areas of the plumes and in the vicinity of Lawnfield Road would decline by up to 75 percent. Treatment system performance will be carefully monitored on a regular basis. If the performance data collected during operation show that this expected decline in VOC concentrations is not being achieved, then EPA will adjust system operations. Such modifications may include any or all of the following.

  - alternating operation of air stripping wells to eliminate stagnation areas;
  - installing additional air stripping wells to facilitate or accelerate cleanup of the contaminant plumes; and
  - extending the time period of treatment system operation beyond five years.

  If the system performance data confirm the expected decline in VOC concentrations is being achieved after five years of operation, then EPA will discontinue operating the air stripping wells. However, EPA may continue operating the treatment system if it determines that continued operation would shorten the remaining time to achieve the remediation goals in a cost-effective manner.

- Placing and enforcing institutional controls on the western lot of Parcel A and Parcel B to ensure access for treatment systems operations and monitoring purposes and to limit future use of contaminated groundwater. The institutional controls will include property use restrictions or restrictive easements, and warning signs. Title to

Parcel B was transferred to DEQ in 1997 under the terms of a Consent Decree with Wayne Hall, the previous owner. The Oregon DEQ presently manages Parcel B in trust for EPA and DEQ, under the terms of a Memorandum of Agreement. A sale of Parcel B requires EPA approval. Therefore, EPA expects to be able to obtain and enforce institutional controls on Parcel B. As long as DEQ has ownership of Parcel B, DEQ will be the enforcing agency for the groundwater institutional controls. At such time as DEQ, with EPA approval, sells or otherwise transfers ownership of Parcel B, EPA expects that the institutional controls will transfer with title and run with the land. EPA and DEQ desire to return Parcel B to productive reuse. Prospective purchaser agreements may be used by DEQ and EPA to ensure institutional controls are maintained in place over time by future owners of the property. The western lot of Parcel A is currently owned by ODOT. EPA will work with ODOT to place similar groundwater and access institutional controls on the ODOT property. When groundwater at the site meets the remediation goals, the institutional controls limiting its use will be removed. EPA will coordinate implementation of groundwater institutional controls with the soil institutional controls specified in the Soil OU ROD

10.3 EXPECTED OUTCOMES OF THE SELECTED GROUNDWATER REMEDY

This section presents the expected outcomes of the selected remedy in terms of resulting land and groundwater uses and risk reduction achieved as a result of the selected groundwater response action.

- Following completion of construction of the groundwater remedy, Parcel B will be able to be reused for commercial/light industrial purposes which do not require the use of on-site groundwater. Since potable water supplied by Clackamas Water District is already available to the site and adjacent businesses, the institutional restriction on use of on-site groundwater is not expected to present an obstacle to the property development. Maintenance workers on the site will not be exposed to contaminated groundwater. The groundwater institutional controls will provide an immediate significant reduction in the human health risk posed by the on-site groundwater.

- When groundwater remediation goals are met at a future date, the institutional controls can be removed, allowing future users of the site groundwater to be free from unacceptable health risks from exposure to the groundwater. Human health risk to future on-site maintenance workers will be reduced by one order of magnitude. Human health risk to future off-site residents will be reduced by two order of magnitude. Maintenance workers at the site will be able to conduct normal working activities with proper safety measures without being exposed to unacceptable health risks due to groundwater contamination.

- Remediation goals for groundwater chemicals of concern (COCs) are presented in **Table 10-1**. The RGs for the COCs were selected to correspond to an excess lifetime cancer risk of 1 X 10^{-6} from direct contact and ingestion of groundwater and are protective of groundwater used in the future for drinking water by an off-site resident (see Section 7.2). Since the remediation goals will not likely be met for more than fifty years, the selected remedy includes placement of institutional controls to limit exposure to groundwater COCs until remediation goals are met.

Table 10-1
Groundwater Remediation Goals for COCs

COC	GROUNDWATER REMEDIATION GOAL
Tetrachloroethene (PCE)	1 μg/L
Trichloroethene (TCE)	1.6 μg/L
Vinyl Chloride	1 μg/L

Notes
COC- Chemicals of Concern
μg/L - micrograms per liter, or parts per billion

10.4 SUMMARY OF THE ESTIMATED GROUNDWATER REMEDY COSTS

Estimated costs of the selected groundwater remedy are presented in **Table 10-2.** Present worth O&M is based on a 5% discount factor for a period of 30 years. This is an order-of-magnitude engineering cost estimate that is expected to be within -30 to +50 percent of the actual project cost.

Table 10-2
Cost Estimate Summary for the Selected Groundwater Remedy
Alternative G3b—In Situ Air Stripping Source Control and Plume Interception

Item	Units	Quantity	Unit Cost	Cost
In Situ Air Stripping Source Control				
Stripping well installation	EA	10	$6,000	$60,000
Well vaults	EA	10	$3,000	$30,000
4-inch pipe installation (trench)	LF	1250	$35	$43,750
Equipment trailer	EA	5	$130,000	$650,000
Electrical hookup	EA	5	$10,000	$50,000
Off-gas treatment unit	EA	5	$5,000	$25,000
O&M				
Operations*	YR	5	$31,000	$134,214
Maintenance*	YR	5	$30,000	$129,884
Blower electricity*	YR	5	$17,500	$75,766
Carbon*	YR	5	$30,000	$129,884
In Situ Air Stripping Plume Interception				
Well installation	EA	4	$6,000	$24,000
Well vaults	EA	4	$3,000	$12,000
4-inch pipe installation (trench)	LF	500	$35	$17,500
Equipment trailer	EA	2	$130,000	$260,000
Electrical hookup	EA	2	$10,000	$20,000
Off-gas treatment unit	EA	2	$5,000	$10,000
O&M				
Operations**	YR	30	$25,000	$384,311
Maintenance**	YR	30	$12,000	$184,469
Blower electricity**	YR	30	$10,500	$161,411
Carbon**	YR	30	$400	$6,149
Monitoring				
Well installation (20 ft bgs)	EA	17	$2,000	$34,000
Well installation (55 ft bgs)	EA	17	$5,000	$85,000
Well installation (100 ft bgs)	EA	2	$9,000	$18,000
O&M				
Labor**	YR	30	$19,887	$305,712
Analytical**	YR	30	$18,600	$285,928
Subtotal Capital Costs				$1,339,250
Engineering Expenses	%	7		$93,748
Contingency Allowances	%	10		$133,925
Inflation Adjustment***	%	3		$40,178
TOTAL CAPITAL COSTS				**$1,607,100**
Subtotal O&M Costs				$1,797,728
Engineering Expenses	%	7		$125,841
Contingency Allowances	%	10		$179,773
TOTAL O&M COSTS				**$2,103,342**
TOTAL PRESENT WORTH VALUE				$3,710,442

* Computed using present worth value (P/A, 5%, 5 years)

** Computed using present worth value (P/A, 5%, 30 years)

*** Capital costs were adjusted from 1999 to 2000 dollars using a CPI based inflation rate of 3%

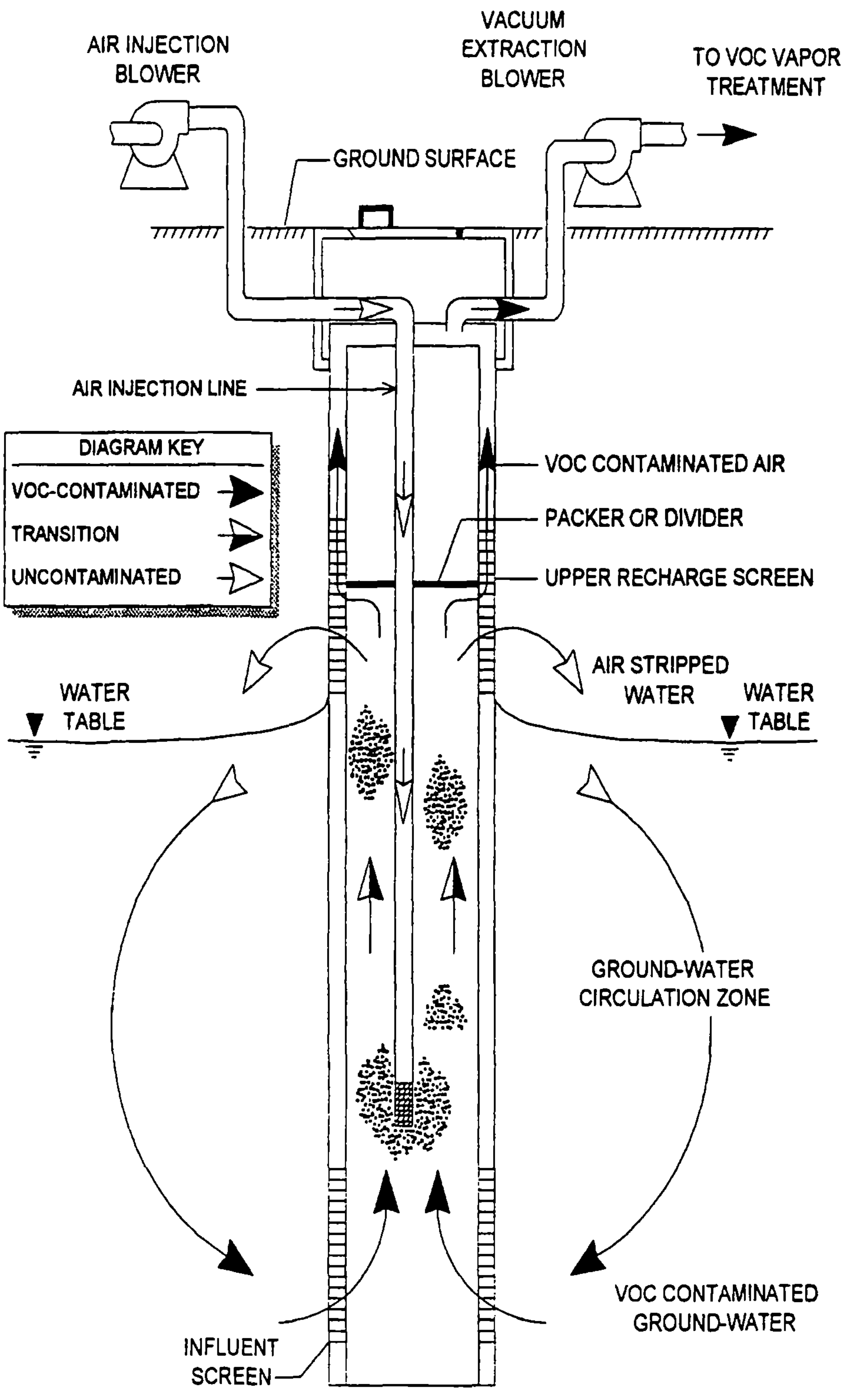
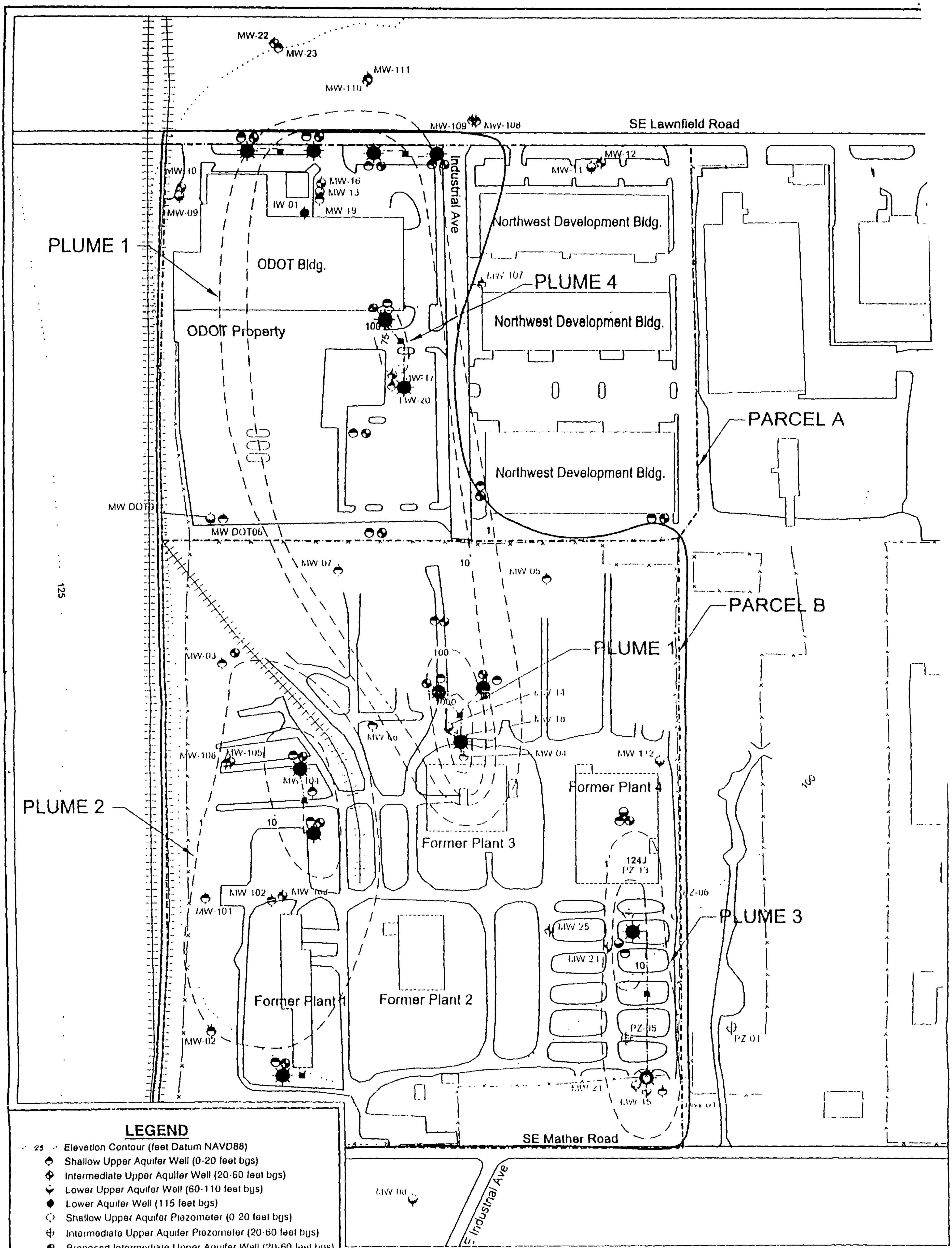


Figure 10-1. IN-WELL VAPOR STRIPPING PROCESS



LEGEND

- 25 Elevation Contour (feet Datum NAVD88)
- Shallow Upper Aquifer Well (0-20 feet bgs)
- Intermediate Upper Aquifer Well (20-60 feet bgs)
- Lower Upper Aquifer Well (60-110 feet bgs)
- Lower Aquifer Well (115 feet bgs)
- Shallow Upper Aquifer Piezometer (0 20 feet bgs)
- Intermediate Upper Aquifer Piezometer (20-60 feet bgs)
- Proposed Intermediate Upper Aquifer Well (20-60 feet bgs)
- Proposed Lower Upper Aquifer Well (60-110 feet bgs)
- Proposed Shallow Upper Aquifer Well (0-20 feet bgs)
- In Situ Air Stripping Equipment Building
- Piping
- In Situ Air Stripping Well (bottom at 50 feet bgs)
- In Situ Air Stripping Well (bottom at 70 feet bgs)

PLANT NORTH 19°

0 50 100 200
SCALE IN FEET

NOTES

1) Contours based on interpretation of 2000 shallow upper aquifer PCE concentrations

2) Bold contour represents total area of PCE, TCE and vinyl chloride exceedance as reported by Weston 1999

3) Contour interval units in ug/L

Figure 10-2
Northwest Pipe and Casing
Alternative G3b - In Situ Air Stripping Source Control and In Situ Air Stripping Plume Interception

EPA REGION 10

030-RI-CO-10G8
Northwest Pipe and Casing
GW MONITORING REPORT (JULY - AUG 2000) & GW INVESTIGATION ADDENDUM

FILENAME: T\RAC\NWP&C\Sub-Tasks\Annual GW 2000\Alt G-3b dwg
EDIT DATE 01/18/01 AT 13 43

11.0 STATUTORY DETERMINATIONS

Under CERCLA, selected remedies must protect human health and the environment, comply with ARARs, be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Additionally, CERCLA includes a preference for remedies that use treatment to significantly and permanently reduce the volume, toxicity or mobility of hazardous wastes, as their principal element. The following sections discuss how the selected groundwater remedy for the Northwest Pipe and Casing Company OU 2 meets these statutory requirements.

11.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected groundwater remedy will protect human health and the environment by·

- Reducing the highest levels of COCs in all upper aquifer groundwater plumes through treatment to permanently remove COCs from the groundwater, and

- Preventing ingestion, dermal contact and inhalation of volatiles from groundwater containing COCs above health-based levels.

The remedy will prevent access to groundwater COCs where they are present and reduce through treatment the highest levels of COCs at potential future points of exposure. The implementation of institutional controls will help assure the on-going protectiveness of the remedy by limiting exposure to COCs in groundwater until remediation goals are achieved

Implementation of the selected remedy is not expected to pose unacceptable short-term risks or significant cross-media impacts.

11.2 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The selected groundwater remedy for the Northwest Pipe and Casing Company Superfund site will comply with federal and state ARARs that have been identified. No waiver of any ARAR is being sought or invoked for the selected groundwater remedy. Where a state ARAR is more stringent than a corresponding federal ARAR, only the state ARAR is identified The chemical-, action-, and location-specific ARARs identified for the site follow.

Oregon Environmental Cleanup Rules (OAR 340-122) is applicable for the establishment of cleanup levels and selection of remedial actions for groundwater, soil and other media. OAR 340-122-040(2) requires that hazardous substance remedial actions achieve one of four standards: a) acceptable risk levels, b) generic soil numeric cleanup levels, c) remedy-specific cleanup levels provided by ODEQ as part of an approved generic remedy, or d) background levels in areas where hazardous substances occur naturally. The risk-based cleanup levels under OAR 340-122-040(2)(a) above are appropriate for the groundwater at the Northwest Pipe and Casing Company site based on the complexity of the site and coordination with DEQ.

OAR 340-122-115 defines the following maximum acceptable risk levels:

- 1 0E-6 for individual carcinogens
- 1.0E-5 for multiple carcinogens, and
- a Hazard Index of 1.0 for noncarcinogens

These acceptable risk levels were used as a basis to establish groundwater remediation goals (RGs) for the site, taking into account the current and reasonably likely future land and groundwater uses, as presented in **Table 7-1.** These RGs are applicable to upper aquifer groundwater at the site where COC concentrations in groundwater exceed the RGs and will be achieved through a combination of groundwater treatment, natural processes, monitoring and institutional controls.

Safe Drinking Water Act (SDWA) and Implementing Regulations (40 CFR Part 141) are applicable to the use of groundwater at the site for drinking water The SDWA regulations establish Maximum Contaminant Levels (MCLs) for chemicals in groundwater used for drinking water. These MCLs will be applicable to the restoration of the upper aquifer groundwater as a source of drinking water

Oregon Well Construction and Abandonment Standards (OAR 690-210 and 690-022) are applicable to the construction and abandonment of wells constructed for any purpose. These rules will be applicable to the *in-situ* air stripping and monitoring wells installed at the site.

Oregon Solid Waste Management Rules (OAR 340-093 through -097) are applicable for the disposal of non-hazardous soil and debris from the construction of the groundwater remedy. Section 340 093-0170 is applicable to the disposal of cleanup materials contaminated with hazardous substances that are not in themselves hazardous substances, such as petroleum contaminated soil Such material must be disposed only in landfills meeting the RCRA Subpart D design criteria and that have been authorized to receive this type of material by DEQ. Section 340 093-0190 is applicable to the disposal of special wastes, including construction and demolition debris and oil wastes.

Oregon General Emission Standards for Particulate Matter (OAR 340-208-0100 through -0210) is applicable to visible emissions and nuisance conditions associated with the construction and operation of from the selected groundwater remedy. The Northwest Pipe and Casing Company site is located in a designated Special Control Area Consequently, dust generated from earthwork or other disturbance of on-site soils must meet a nuisance condition standard for fugitive emissions traceable directly to a specific source In addition, opacity and particulate matter concentration standards are applicable to vehicle emissions on-site.

Oregon Water Quality Management Plan (OAR 340-041 and -045) is applicable to the management of storm water runoff from the site. Water quality criteria in the Willamette Basin (location of the Northwest Pipe and Casing Company site) not to be exceeded are specified for dissolved oxygen, temperature, turbidity, pH, bacteria, radioisotope concentrations and total dissolved solids. Construction activities associated with the selected groundwater remedy will comply with OAR 340-041.

Endangered Species Act of 1973 as amended (16 U.S.C. 1531 et seq) is applicable to construction of the selected groundwater remedy. Federal agencies are required to consult with the appropriate Service when an activity authorized, funded or carried out by that agency may affect a listed species of concern or designated critical habitat.

EPA conducted an informal consultation with the National Marine Fisheries Service (NMFS) concerning the selected groundwater remedy. The NMFS concurred with EPA's determination of no adverse effects, provided erosion control measures are taken during construction to minimize degradation of downstream surface water quality and aquatic habitat. NMFS concurrence completes the consultation process.

Federal Executive Order 11990 for Protection of Wetlands is applicable to the wetlands present on the site. Construction and operation of the remedial action in or near the wetlands area will avoid adverse impacts, minimize potential harm, and preserve and enhance the wetlands to the extent possible

Oregon Hazardous Wastes Management Rules (OAR 340-100 through -120) may be applicable to spent carbon from the well vapor treatment units if the carbon exhibits a characteristic of hazardous wastes. Subtitle C of the federal Resource Conservation and Recovery Act (RCRA) establishes a system for the management of hazardous wastes. EPA has adopted extensive requirements for hazardous waste handlers under regulations in 40 CFR Parts 260 through 265 and 268. The state of Oregon has adopted most of the RCRA Subtitle C regulations as state regulations in OAR 340-100 through -120.

EPA will test the spent carbon for hazardous waste characteristics If the carbon is required to be managed as a RCRA hazardous waste, EPA will comply with Oregon RCRA requirements pertaining to the generation, storage, transport, treatment and disposal of hazardous waste

Oregon Air Pollution Control Standards (OAR 340-030 through 340-032) would be applicable if the emissions of VOCs into the air exceeded the regulatory threshold of one ton per year. However, the estimated VOC emissions from the selected remedy will be substantially lower than the regulatory threshold because VOC-containing vapors will be treated with activated carbon before discharge to the air.

11.3 OTHER CRITERIA, ADVISORIES OR GUIDANCE

This section discusses other criteria, advisories, or guidance considered to be appropriate for the selected groundwater remedy for the Northwest Pipe and Casing Company Superfund site.

The *State of Oregon Best Management Practices (BMPs) for Storm Water Discharges Associated With Construction Activities* will be considered during design of the selected groundwater remedy.

11.4 COST-EFFECTIVENESS

The selected groundwater remedy for the Northwest Pipe and Casing Company Superfund site is more costly than some alternatives and less costly than other alternatives evaluated for the groundwater operable unit. Taking no action to remediate groundwater would be considerably less costly than the selected remedy, but would not be protective of human health and the environment. Using monitored natural attenuation would be less costly than the selected remedy, but may not be protective of human health and the environment due to the uncertainty of its effectiveness under the site-specific conditions at Northwest Pipe and Casing. Pump and treat alternatives are roughly as or more costly than the selected remedy, with site-wide pump and treat being the most costly alternative.

The selected groundwater remedy is cost-effective because it is protective of human health and the environment, attains ARARs, and its effectiveness in meeting the remedial action objectives is proportional to its cost.

11.5 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected groundwater remedy for the Northwest Pipe and Casing Company Superfund Site represents the maximum extent to which permanent solutions and treatment can be utilized in a cost-effective manner It is protective of human health and the environment, complies with ARARs, and provides the best balance of tradeoffs in terms of long-term effectiveness, permanence, short-term effectiveness, implementability, cost, and reductions in toxicity, mobility or volume of hazardous substances The selected groundwater remedy meets the statutory requirements for using permanent solutions to the maximum extent practicable. Not all of the action alternatives for groundwater were found to achieve comparable overall protection of human health and the environment nor to be equally effective in achieving the cleanup goals Therefore, the alternative considered to be more effective than others in reducing contamination levels, utilizing permanent solutions and cost-effective in attaining the remedial action objectives in proportional to its cost was selected

The groundwater remedy will not recover any contaminant in significant quantity or in a pure form so as to allow reuse of the contaminant as a resource. However, if the spent activated carbon used to remove VOCs in vapor stripped from the groundwater is regenerated for reuse, it would represent use of resource recovery technologies to the maximum extent practicable at the Site

11.6 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The selected groundwater remedy for the Northwest Pipe and Casing Superfund Site includes the following treatment components as principal elements.

- *In-situ* air stripping of VOCs from the most highly contaminated areas of groundwater and activated carbon treatment of VOC vapors, which permanently removes the contaminants from the groundwater.

11.7 FIVE-YEAR REVIEW REQUIREMENTS

The Five-Year Review is required pursuant to CERCLA Section 121(c) and the NCP Part 300.430 (f)(5)(iii)(C) because the selected groundwater remedy will not result in VOC concentrations in groundwater that allow for unlimited and unrestricted exposure throughout the site until the cleanup goals are met. The Five-Year Reviews evaluate whether the groundwater remedy remains protective of human health and the environment in the future. The first Five-Year Review will be conducted no later than 5 years after the initiation of the Soil Remedial Action. Five-Year Reviews will be conducted thereafter.

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12.0 DOCUMENTATION OF SIGNIFICANT CHANGES

A minor change to the remedy as originally identified in the Proposed Plan was made by EPA. This change involved the timing of installing the *in-situ* air stripping wells along Lawnfield Road. EPA decided to install these air stripping wells at the same time as construction of the other groundwater stripping wells, rather than wait for annual groundwater monitoring data to show groundwater was migrating off-site, as provided for in the Proposed Plan. This change in construction timing provides added assurance that contaminated groundwater will not move off-site.

This change is not significant, since it does not affect the scope, performance or cost of the selected groundwater remedy

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APPENDIX A

Responsiveness Summary

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APPENDIX A
RESPONSIVENESS SUMMARY

The responsiveness summary addresses public comments on the proposed plan for groundwater remedial action at the Northwest Pipe and Casing Superfund Site. A public comment period for the proposed plan for the groundwater OU was held from May 17 through June 18, 2001. The notice of availability of the proposed plan and opportunity to comment was published in the Oregonian newspaper on May 17, 2001. A public meeting was not held due to the lack of interest and request. Two public comments were submitted by ODOT and Clackamas County Water Environment Services

SUMMARIZED PUBLIC COMMENTS

Comment: *Are there wetlands on the site? Clackamas County Water Environment Services (WES) recommends that the open drainage channels be evaluated for eligibility for "waters of the state". If the open drainage channels present on the site are eligible for intermittent/perennial creek status, WES encourages EPA to avoid or minimize ground-disturbing activities within 50 feet of the top of the bank. WES also encourages EPA to consider protecting these riparian areas through the establishment of a conservation easement and through restoration-based projects.*

Response: A Wetland Delineation Survey conducted for EPA in May 2001 concluded that a small area of wetlands, totaling approximately one acre in size, are present in the northwest portion of the site. EPA does not expect construction of the groundwater remedy to adversely impact these wetlands or the adjacent surface water drainage channels. During the design phase of the soil cap on Parcel B (Phase 2 of the Soil OU Remedy) EPA will address the ultimate disposition of the wetlands and evaluate necessary riparian protection measures, including use of native plants for revegetation

EPA will further discuss the regulatory status of the open drainage channels with WES and other appropriate agencies

Comment: *A delineated wetland is present on other property adjacent to the northeast corner of Parcel B. EPA should consider the establishment of a designated protected area on that corner of Parcel B which is within 50 feet of the delineated wetland's edge.*

Response: During the design phase of the soil cap on Parcel B (Phase 2 of the Soil OU Remedy) EPA will evaluate necessary riparian protection measures for Parcel B.

Comment: *Water Environment Services supports the selection of Alternative G3b.*

Response: Comment noted

Comment: *Notify Clackamas County if groundwater pollution is discovered to have migrated offsite in any direction; if groundwater is found to be leaving the site in surface drainage from* *springs, drain tiles, etc. or; if fluids are discharged to surface waters from the construction or operation of the air stripping wells.*

Response: EPA does not expect the air stripping wells to result in discharges to surface waters. EPA will provide copies of future groundwater monitoring reports and site cleanup status reports to Clackamas County WES.

Comment: *Coordinate with personnel at the ODOT Lawnfield Road Maintenance Facility early in the selection process regarding the locations of air stripping wells and appurtenances on the ODOT parcel and in development of institutional controls.*

Response: During design of the groundwater remedial action, EPA will coordinate with ODOT Lawnfield Road Maintenance Facility personnel on the locations for air stripping wells and auxiliary equipment on the ODOT property. EPA will also work closely with ODOT in developing and implementing the institutional controls for the groundwater remedy

Comment: *ODOT is unfamiliar with the in-situ air stripping technology. Are there sources for more information about its effectiveness?*

Response: In a letter dated July 17, 2001 to ODOT, EPA provided the references for several readily available documents which contain detailed information on groundwater *in-situ* air stripping wells EPA also provided the internet addresses for electronic web sites where these documents were available to read or download.

Comment: *ODOT would like EPA to meet with employees at the ODOT Lawnfield Road Maintenance Facility to discuss the upcoming soil remediation activities.*

Response: On July 13, 2001 EPA and URS Corporation, EPA's soil remedy contractor, met with ODOT employees. EPA and URS representatives discussed and answered questions about the construction of Phase 1 of the Soil OU remedial action, planned to start in early August. EPA agreed to periodically provide progress updates during the soil cleanup to the ODOT facility Office Manager.